Operating and Service Manual

GOULD

Electronics & Electrical Products

GOULD

Electronics & Electrical Products

MANUAL PART NO.
15-803307-XXS

GOULD 3052, 3054 & 3056
X-Y RECORDER
ALL MODELS
SERVICE MANUAL

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Innovative design, coupled with highest quality, are hallmarks of all Gould products.

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An extended warranty is available at the point of sale allowing a regulated budget for the first two years of ownership. You may take advantage of this warranty within the first year of ownership at a percentage of the current listed price.

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SECTION I

INTRODUCTION

This manual contains complete information required to service and repair the Gould 305X X-Y Recorder. It is intended to complement the Operator's Manual, part number 15-803307-XXU, which is supplied with every recorder.

This service manual includes a detailed theory of operation, a section describing internal calibrations and adjustments, and helpful troubleshooting information. Also included are instructions to aid replacing any part or assembly that might require them, as well as a complete parts identification section with exploded views. All schematics may be found in the Appendix at the back of this Manual. Certain discussions pertain to the Model 3054 as exemplary.

Please consult the Operator's Manual mentioned above for installation and operating instructions, operative and preventive maintenance information, product specifications and other user information.

MODEL NUMBER DESCRIPTIONS

RECORDER	MODEL NUMBER	DESCRIPTION	
3052	15-3307-02	English units.	
3052	15-3307-08	Metric units.	
3052	15-3307-12	English. With Time Base.	
3052	15-3307-18	Metric. With Time Base.	
3054	15-3307-00	English	All 3054's have calibrated zero offset up to ±500%.
3054	15-3307-06	Metric	
3054	15-3307-10	English. With Time Base.	
3054	15-3307-16	Metric. With Time Base.	
3056	15-3307-01	English.	All 3056's have calibrated zero offset up to ±1000% and high gain preamps.
3056	15-3307-07	Metric.	
3056	15-3307-11	English. With Time Base.	
3056	15-3307-17	Metric. With Time Base.	

SECTION II

THEORY OF OPERATION

2.1 INTRODUCTION

The function of the Gould Model 15-3307-XX X-Y Recorder is to make pen plots in two axes. Each axis is independent of the other and electrically floating. It has sensitivities ranging down to .025mV/in. (.01mV/cm), with 1000% zero offset*. The recorder writes on paper with an easily replaceable felt tip pen available in four different colors. It also has switch selectable limits for writing on either 8½" x 11" or 11" x 17" chart paper, which is electrostatically held to the writing table.

This recorder also has an optional time base used to plot against time. Time base is selectable on either the X or Y axis. It features an "END OF SCAN" control to stop the sweep at any point desired on the paper.

A remote control connector provides external control of both recorder and time base functions.

2.2 GENERAL (3054 TYPICAL)

Refer to System Schematic 294224. All schematics may be found in the appendix at the back of the Service Manual.

This recorder consists of a preamp and drive (Servo) amp for each axis, a misc. power supply and optional time base.

The preamp serves to condition the incoming signal for recorder operation. A full scale output from the preamp is 5.0 volts. The preamp also has filtering to reduce unwanted noise, and a 5Hz switchable filter for customer use. The zero offset circuitry is also contained in the preamps.

The drive amp contains the servo circuitry. It sums together the pen position and preamp/timebase signals to move the pen accordingly. For the servo to operate it must have some sort of position feedback to know where the pen is located. This is done by mounting a precision resistive element (conductive - plastic potentiometer) on each axis. Supplying this element is a + and − 10 volt reference. As the pen moves a contact picks up between + and − 10 volts and sends this signal to the drive amp.

The time base supplies a ramp signal to the drive amp causing the pen to move at a constant rate. When the time base is switched in, the preamp for that axis is disconnected.

The miscellaneous power supply supplies power for the time base, pen lift solenoid, remote control logic, table target lights, pilot lamp, and electrostatic hold down.

2.3 CHASSIS (3054 TYPICAL)

Refer to Schematic 294224.

Power enters the unit through a bidirectional line filter. This filter prevents normal RFI noise from entering or leaving the plotter via the line. Also located in the line filter module is a line voltage selector card. This is a small P.C. board which can be inserted into the filter module in four different ways to select either 100, 120, 220 or 240 vac line operation. Operation at different line voltages is accomplished by various series-parallel combinations of the transformer primaries.

Four switches are located on the front panel (See Schematic 294202). One switches the incoming power to turn the recorder on and off. Two switches control the "Standby Operate" and "Pen Down" functions, and one switches the high voltage for the writing table paper holddown.

The writing table uses an electrostatic field to hold the paper to its surface. The field is generated when 1000 Vdc is applied to a grid of conductors just below the surface of the table. Chart paper alignment is aided by six fiber optic light pipes which transmit light from one bulb mounted under the table to various points on the table's surface.

Mounted on the bottom side of the recorder are two external analog input jacks (J3 & J4), a "D" type connector for external control and a metal binding post for chassis ground. The two analog input jacks are used to feed external analog signals directly into the drive amp. When a ¼" phone plug is placed into this jack it automatically disconnects either the time base or preamp, which ever was connected. The "D" connector allows partial control of the recorder and timebase using either switch contacts or TTL type signal levels.

2.4 PREAMP MODULE

Refer to Figure 2-1 and Schematics 293707 and 293708.

* Not on all models

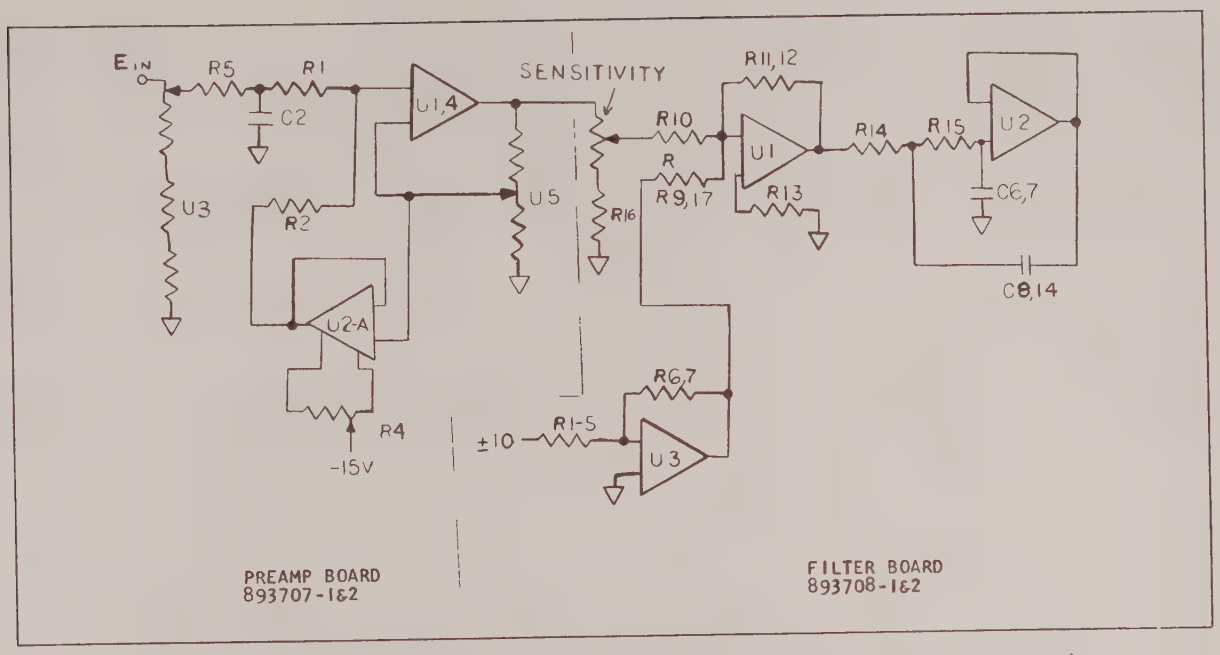


FIGURE 2-1 PREAMP SCHEMATIC, SIMPLIFIED (3054 only)

3054

A simplified schematic of the preamp appears in Figure 2-1. Start at Ein where the input signal enters voltage divider U3. The various taps of U3 are selected by the range switch. The signal is fed into the amplifier through R1, R5 and C2. R5 and C2 provide filtering for the incoming signal. R1 and R5 provide overvoltage protection for U1. The amplifier gain is set by selecting one of the voltage divider taps of U5 with the range switch. Resistor pack U5 is changed for metric units. Amplifier U2-A, R2 and R4 act to null out the bias currents required by U1.

The output signal of U4 goes to the "SENSITIVITY pot (a front panel control). Here the signal is reduced, allowing the user to achieve any "VOLTS/ "DIV" range desired between two switch ranges. Amplifier U3 (Filter Board) and resistors R1-R7 determine the magnitude of the zero offset voltage to be applied to the summing amplifier U1. The summing amplifier adds together the measured signal applied through R10 and the zero offset signal applied through R9 and R17. Since the zero offset voltage is of opposite polarity from the measured signal it is subtracted. The output of U1 is the difference between the two signals times the gain of the amp set by R9, R10, R17, R11 and R12. Amplifier U2 and associated components R14, R15, C6, C7 C8, and C14 form a unity gain two pole filter. For the 5Hz selectable filter, C-7 and C-8 are connected in parallel with C6 and C14. For a more detailed explanation of amplifier operation refer to the next two sections on the preamp and filter boards.

2.4.1 Preamp Board (893707-1 and -2)(3054 only)

Refer to Schematic 293707.

The measured signal enters the preamp and goes to resistor pack U3. This is a precision decade divider, dividing the signal by 10, 100, or 1000. The proper tap is selected by the "x1/x100" switch on the front panel.

The signal then proceeds through R5, R14 and C2. R5 and C2 provide filtering to reduce 60Hz going into the amplifier. R5 and R14 limit current flowing into U1 if too large a voltage is applied. Switch S2 is open during normal operation but closed during calibration to adjust the offset voltage of U1.

Amplifier U1 is a low drift operational amplifier. Amplifier U4 and associated components R7, R8 and C1 form a non-inverting amplifier with a gain of 101:1. Amplifier U2 connected in the manner shown effectively increases the open loop gain of U1. High open loop gain is needed to maintain accuracy. The various taps or resistor network U5 are selected by the range switch S1 to determine the gain of the amplifier.

U2-A, R2 and R4 form a bias nulling circuit. Amplifier U2-A operates as a voltage follower. Since the voltages at the two inputs of U1 are equal the output of U2-A (Pin 12) will equal the voltage at Pin 3 of U1 plus the offset voltage (VOS) of U2-A. Therefore, the current flowing through R2 = VOS/R2 which is adjusted to equal the bias current of U1.

Resistors R6 and R15 function to adjust the offset voltage of U1.

Amplifier U2-B and associated components R9, R10, R11, R13 and C5 form a unity gain inverting amplifier. This serves to invert the polarity of the signal at TP-1. The front panel "NORM/INVERT" switch selects either the signal at TP-1 or TP-2 to be sent to the filter board.

The difference between the english and metric preamps is the values of the resistors in U5. These values are given in the following table. The U5 resistors are designated R1-R7, counting from left to right on schematic 293707.

	893707-1 (English)	893707-2 (Metric)
R1	100	100
R2	100	150
R3	300	250
R4	500	500
R5	1000	1500
R6	3000	2500
R7	5000	5000

2.4.2 Filter Board (893708 -1 and -2) (3054 only)

Refer to Schematic 293708

The signal from the preamp board enters at Pin 5 of J1 and proceeds to Pin 3 of J2. It then goes through the "SENSITIVITY" potentiometer on the front panel and returns to the filter board on Pin 4 of J2. This signal may or may not be attenuated depending on the setting of the sensitivity pot. This signal now enters the summing amplifier U1 thru R-10.

Amplifier U3 and associated circuitry make up the zero offset circuitry. This circuit produces a voltage at TP-3 equal to a full scale voltage (100%, 200% etc.) at TP-2 but opposite in polarity. The reference voltage for this circuit is + and − 10Vdc reference located on the drive board 893230. The +10 or -10 volts is selected by the "+/−" position of S1. This voltage is applied to R-1 thru R-5. For 100% zero offset, R-1 is selected and produces a voltage at TP-3 equal to a full scale voltage at TP-1 (Preamp board) but opposite in polarity. For 200% zero offset, R-1 and R-2 are put in parallel. Now twice as much current flows into the inverting input of U3. This produces twice as much output as before equaling a two times full scale signal.

The zero offset signal at TP-3 goes to the summing amplifier U1 through R-9, R-17 and C-3, along with the measured signal being applied through R-10. The zero offset signal is subtracted from the measured signal and the result is amplified. The gain of U1 is approximately 6.6 for the X-Axis and approximately 10 for the Y-axis. Metric units differ slightly in the settings of R-7 and R-12.

The signal at TP-4 enters a unity gain active filter. With the "filter" switch in the "out" position only C-8 and C-6 are in the circuit. In this configuration the circuit has a -3dB point at 60Hz. With the "filter" switch in the "in" position C-7 is connected in parallel with C-6 and C-9 in parallel with C-8. This reduces the -3dB point to 5Hz.

The output from this board is Pin 15 of J1. This output is a 5 volt full scale signal. It is supplied to the drive amps.

2.4.3 General (Model 3056 Preamp)

A simplified schematic of the preamp appears in Figure 2-1A. The input signal at point "EIN" enters the voltage divider U3. The various taps of U3 are selected by the range switch. This signal is then fed into amplifier U1 through R4, R5 and C4. Amplifier U1 is a solid state chopper amplifier operating in a non-inverting configuration. The amplifier gain is set by selecting one of the taps of resistor pack U2 with the range switch. Resistor pack U2 is changed for metric units.

The chopper output goes to a two pole active filter on the Filter Board (see paragraph 2.4.5). This filter functions as a 5 Hz and 20 Hz filter depending on the front panel "Filter" switch. The filter output goes to the sensitivity pot (a front panel control). Here the signal is reduced to allow the user to achieve any "volts/div" range desired between any two switch ranges. The signal then goes to amplifier U2. Here the offset signal is summed in at the non-inverting input of U2. This signal is derived from a

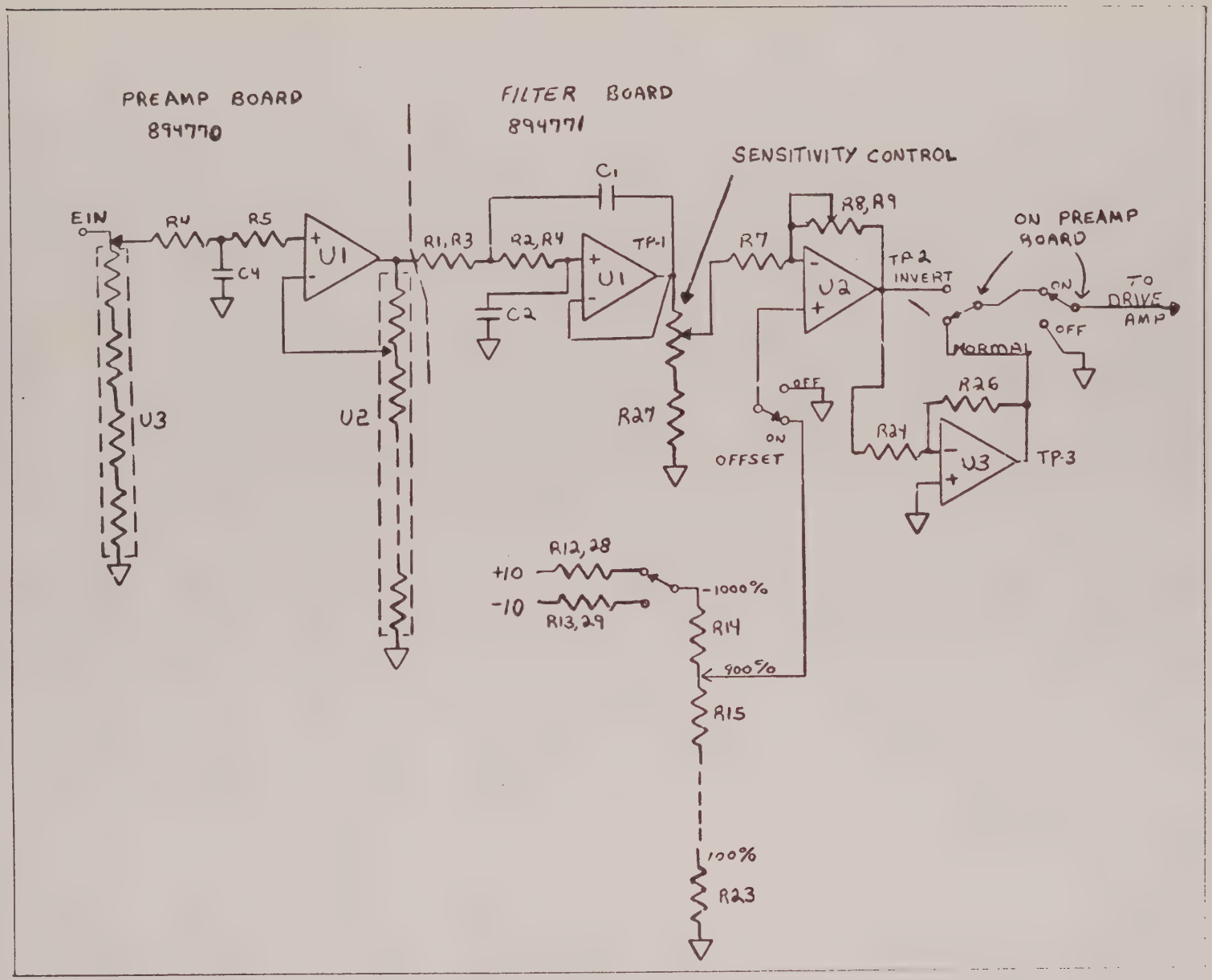


FIGURE 2-1A SIMPLIFIED SCHEMATIC, 3056

±10VDC reference (on the Drive Board) and a voltage divider consisting of R12, R13, R28, R29, R14 thru R23. Amplifier U3 is a unity gain inverting amplifier used to generate the "Normal" signal. A switch on the Preamp Board selects either the "Normal" signal at TP-3, or "Inverted" signal at TP-2 to send to the drive amplifier.

For a more detailed explanation of amplifier operation refer to the next two sections on the Preamp and Filter Boards.

2.4.4 Preamp Board (894770) (Model 3056)

Refer to Schematic 294770.

The measured signal enters the preamp through the low thermal binding posts on the front panel. It then travels through a cable to the Preamp Board. All solder connections to this cable are made with low thermal solder (Cadmium solder).

When the signal enters the board it goes to resistor pack U3. This is a decade voltage divider which divides the signal by 10, 100, or 1000. The various taps of U3 are selected by range switches. The selected signal is fed through R4, R5, and C1 to the chopper amplifier U1. R4, R5 and CR1 through CR4 protect the amplifier from being damaged in case excess voltage is applied to the input. CR1 through CR4 clamp the input voltage so it cannot exceed 1.4 volts. These diodes are low leakage type diodes. R4 and R5 limit the current through these diodes.

Different ranges are obtained by changing the gain of the amplifier. This is done by selecting different taps on resistor pack U2 (a precision ratio matched resistor pack) with the range switch. In addition to selecting different gains, the range switch also selects capacitors C3 thru C6. These capacitors are connected from the output of the chopper amp U1 (pin 6) to the "Compensating Capacitor" input (pin 4) of U1. They determine the frequency response of the chopper amp at different gain settings.

Resistors R3, R8 and the 25 ohm resistor in U2 serve to adjust the offset of U1.

When the preamp operates in the 5 and 10 mV/in (2 and 5 mV/cm) range and X1000 mode, the amp requires the input to be divided by 10,000. U3 by itself will only divide by 1000. If we place a resistor (approximately 111 ohm) in parallel with the 1000 ohm resistor in U3 we can reduce its resistance which will cause the input signal to be divided by 10,000 at pin 4 of U3 instead of 1000. This resistor is composed of the network formed by R2, R6 and R7. R2 compensates for variations in the 1000 ohm resistor in U3.

On the Filter Board (894771) the inverting output TP-2 and non-inverting output TP-3 are routed onto the Preamp Board on pins 3 and 4 of J1. One of these outputs is selected by the "Normal/Invert" switch and routed to the Preamp "Off" switch. If the Preamp is "On" this signal is sent to the Drive Amplifier. If the Preamp is "Off" this signal is disconnected and the input to the drive amplifier is grounded.

2.4.5 Filter Board (894771) (Typical 3056)

Refer to Schematic 294771

The signal from the Preamp Board enters the Filter Board at pin 2 of J3 (chopper out). It proceeds directly to amplifier U1, a 20 Hz active filter. In normal operation of the filter, resistors R1 and R3 are in parallel and R2 and R4 are in parallel. When the 5 Hz filter is selected by the front panel switch, R3 and R4 are disconnected. Now only R1 and R2 are left to make up the 5 Hz filter. The purpose of this 20 Hz filter is to filter out noise generated by the chopper amplifier. The full scale output voltage of this filter (TP-1) is .5V for the Y axis, and .75V for the X axis.

This signal proceeds to the front panel sensitivity pot and R27. These two resistors form a voltage divider allowing the signal feeding U2 to be reduced to less than 40%, depending on the setting of the sensitivity pot.

Amplifier U2 is an inverting amplifier with a gain of 10 for the Y axis and 6.6 for the X axis. Metric units vary slightly. Its output (TP-2) is a 5.0 volt full scale signal.

Amplifier U3 is a unity gain inverting amplifier. It takes the signal at TP-2 and inverts it at TP-3. R26 adjusts the gain to exactly one by compensating for the mismatch of resistors R24 and R25.

Under normal operating conditions the non-inverting input pin 3 of U2 is grounded through R6 and the zero offset "On/Off" switch. When zero

offset is required we null out the signal feeding the inverting input (pin 2) of U2 by applying a voltage to the non-inverting input (pin 3) of U2. This voltage is less than the voltage at the inverting input due to a gain difference. The signal applied to the inverting inputs sees a gain of (R8 + R9)/P7 (approximately 10 for the Y axis). The signal applied to the non-inverting input sees a gain of 1 + (R8 + R9)/R7 (approximately 11 for the Y axis). Since this gain is higher less voltage is needed at the non-inverting input to zero output. For 100% offset .454 volts for the Y axis and .651 volts for the X axis is required at the non-inverting input to zero the output. This voltage is obtained by voltage divider action of R14 through R23. Each step of the divider adds 100% offset. The voltage for this divider comes from the ±10 volt reference on the drive amp board (893230). Resistors R28 and R12 are used to calibrate the "+" zero offset and R29 and R13 for the "—" offset.

For normal operation of the preamp, the signal at TP-3 is selected by the front panel switch. For "inverted" operation TP-2 is selected by the front panel.

2.5 DRIVE AMP 893230 (All Models)

Refer to Schematic 293230

2.5.1 General

Each drive amplifier board includes a dc servo amplifier which controls a reversible dc motor used to position the pen of the X-Y recorder. There are two motors and drive amplifier boards, one for each axis. Since they differ only in minor aspects they should be considered identical for this initial discussion. The differences will be treated later.

Each driver board is powered from adjacent chassis-mounted isolation transformers. All operating voltages for the drive board and its associated preamplifier are developed on the drive board from this isolated winding. All voltages are electronically regulated on the board. Connectors are provided to allow easy removal of the drive board and permit circuit isolation for service.

The circuit compares the input signal from the "X" input with the voltage developed by the "X" position sensor (the "X" pen position). A high gain amplifier produces a correction voltage which is fed to the "X" drive motor repositioning the pen as required. At the same time a similar feedback action takes place in the Y axis - following the Y input signal.

Provisions are incorporated for limiting the X and Y travel electrically to prevent wear and tear on mechanical stops. Also included are self protective circuits to prevent overloading of amplifiers, motors or other components. Such overloading could be caused, for example, by prolonged accidental or intentional restriction of the pen motion. The same circuitry also controls the drive to reduce power when the recorder is first enabled and the pen position is a long way from the correct location. The pen will gently lock in and then go to full power.

All motor drive can be removed by placing the front panel control in "STANDBY". This standby/operate function is also remotely controllable without compromising common mode or input isolation.

With the timebase option, signals from the preamps are routed through the timebase switching circuits. When required, the timebase signal is substituted for a preamp signal.

Controls are accessible by tilting the control panel for adjusting span calibration, servo loop gain (deadband and pen stiffness), damping (pen overshoot), and high and low electrical pen limits (for both nominal 10" x 15" grids and for 8½ x 11" paper).

Inputs direct to the ±2.5 volt 1 megohm drive amplifier input are available thru the remote input jacks without disabling the preamp pen positioning controls. (The preamp output is not used with remote inputs.)

Since the Drive Amplifier is one of the most complex boards, the different functions will be explained in detail in the following separate sub-sections. Refer to Figure 2-2, SIMPLIFIED DRIVE AMPLIFIER SCHEMATIC, as well as Schematic 293230.

2.5.2 Input Signal

The input signal to the drive amplifier normally comes from the preamplifier connected to J4-15 of the drive amplifier. This input immediately leaves the drive board via J5 Pin 1 eventually

returning on Pin 2 of J5. Enroute, either the timebase ramp output or an external signal from the remote input jacks may be substituted for the original preamp signal. (Refer to the Theory of Operation for the misc. power board for details.)

An auxiliary input, J4-13, is available for test purposes.

To move the pen full scale (15" in the X axis, 10" in the Y axis), supply a signal of -2.5 volts to +2.5 volts at pin J5-2 or J4-13. (The pen position should first be set at chart center with zero input.)

2.5.3 Operational Amplifier U1-A

The functions of U1-A (Pins 5, 6 and 7) are as follows:

1. Provide a high dc impedance input (1 meg) when the signal input is via the "remote input" jacks.
2. Allow the phase of the X and Y axes to be matched at 1 hertz by varying R_1C_{11} (Y axis has an adjustable R1).
3. Provide a gain of 2 (±5 volts full scale output) to operate the limiter circuit at its design level. In this op amp configuration the gain is selected by setting the ratio of R_4 to R_3 i.e., ($V_{out} = V_{in} + V_{in} \bullet \frac{R_4}{R_3}$). The gain is therefore 2 with $R_4 = R_3$.

2.5.4 Limiter Circuit

Operational amplifier U1-B (pins 1, 2 and 3) drives the limiter diodes CR3 through CR6. This circuit functions as follows:

1. The summing junction (-) (pin 2) of U1-B combines the input current from the span control resistors (R5 and R6) with the input current from the coarse and fine position controls via R9. The output of the diode limiters is also summed in at this junction to give a sharp electronic limit via R7.
2. Except when the maximum output set by the diode limiters is exceeded by the input, $U1_B$ acts as a linear amplifier with approximately unity gain as determined by the ratio of R7 to (R5 + R6). Varying R5 gives ±10% change in the signal gain thru the limiter stage.
3. A detailed description of the limiter operation follows:

   This circuit sets the electrical limits to the signal that reaches the drive amplifier for the recorder. Proper operation is based on the following requirements:

   - The limits must not interfere with the linearity of the input signal.
   - The limiter must cut off sharply enough so that the pen never reaches the mechanical stops when set one or two percent beyond full scale.
   - The pen position signal is inserted before the limiter so that it holds the manual positioning movements within the mechanical limits.
   - The servo control is adequate to prevent damage from overshoot.

   This circuit makes use of a diode bridge in an operational amplifier feedback loop to obtain the required linearity and sharp cutoff. The diode bridge operates by using a normally conducting diode network as shown in Figure 2-3, SIMPLE DIODE LIMITER.

As the input is made more positive less current flows thru CR_1 and more thru CR_4. This causes more current thru CR_2 and less thru CR_3. The values of R_1, R_2 and R_3 and the + and − voltages E_1 determine at what point the input voltage is looking into a circuit which can now be simplified as shown in Figure 2-4.

At this time, with perfect diodes, the input is disconnected from the output. The output voltage is defined by the current thru R_3 times R_3 or $\frac{(E - 0.6V)}{(R_1 + R_3)} \bullet R_3 = E_0$. For E = 15V, R_3 = 1.78K and E_0 to be +5V, the value of R_1 can be calculated as $\frac{14.4}{1.78K + R_1} \bullet 1.78K = 5$ or R_1 = 3.42K.

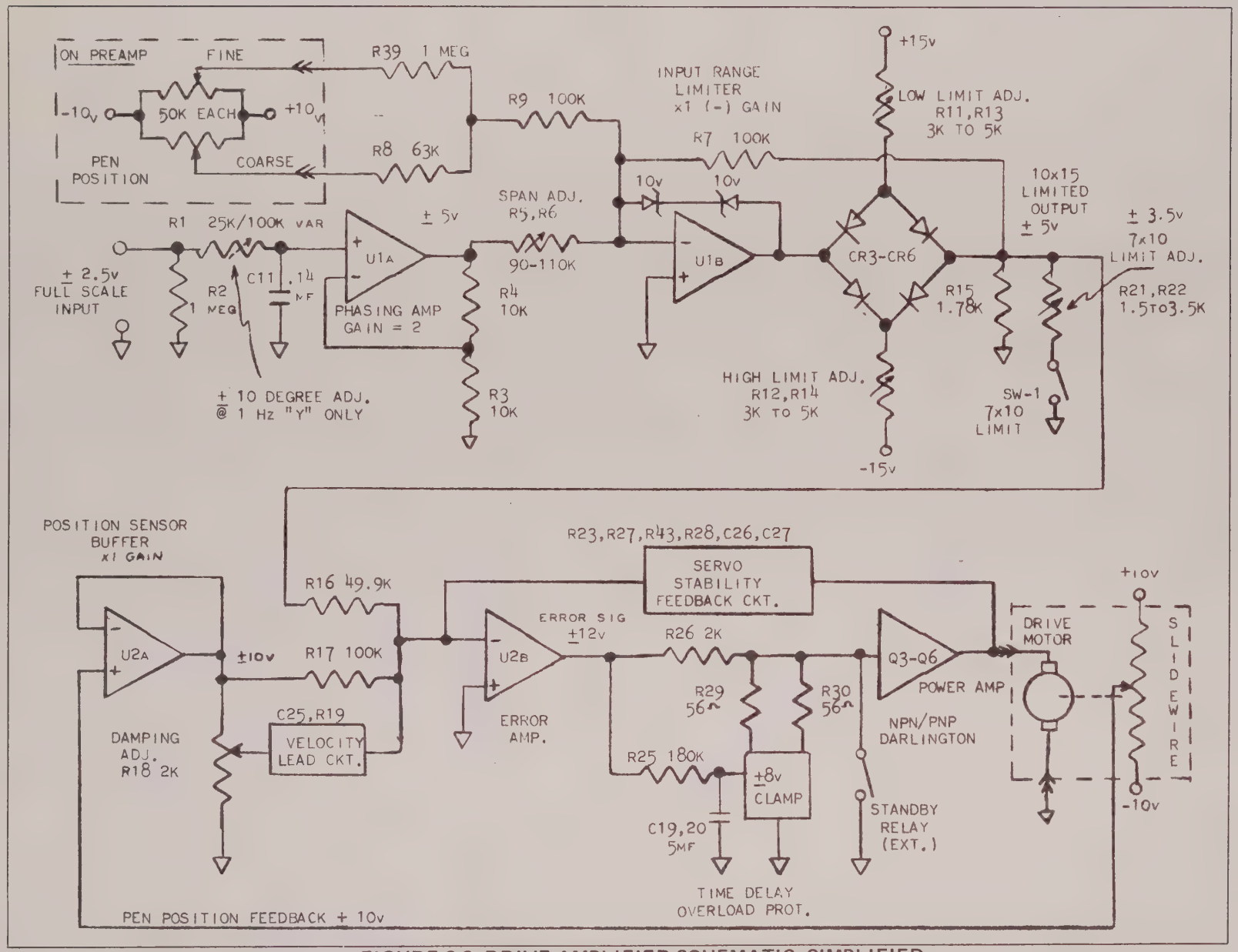
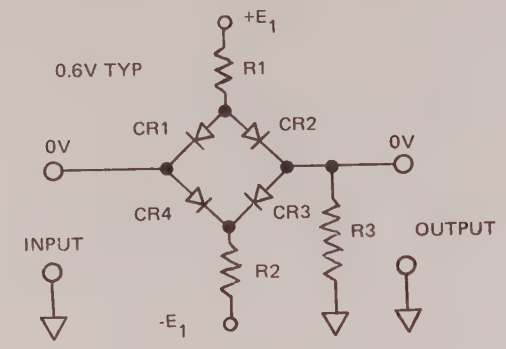


FIGURE 2-2 DRIVE AMPLIFIER SCHEMATIC, SIMPLIFIED



Input at 0, all diodes conduct . . . . . 0.6V drop across each diode. Polarities cancel so the input and output voltage are equal.

FIGURE 2-3 SIMPLE DIODE LIMITER

If the input signal is reversed, diodes CR_1 and CR_3 will conduct. CR_2 and CR_4 will be biased off. If R_2 = 3.42K, the output will hold at -5 volts for any larger negative signal at the input.

If we now add the high gain operational amplifier to supply the current needed at the diode bridge input and complete the circuit with feedback resistor R_4 we have Figure 2-5, the circuit as used.

As long as the output from the diodes is equal but of opposite polarity to the input signal, U1B acts as a conventional gain of -1 amplifier with excellent linearity. As soon as the output starts to limit at + or -5 volts, however, the error signal at the summing junction (-) of U1B makes the output of U1B become very large (approx. 13V). This quickly switches the diodes as in Figure 2-4 (if the input is +), placing the output in the full limited condition.

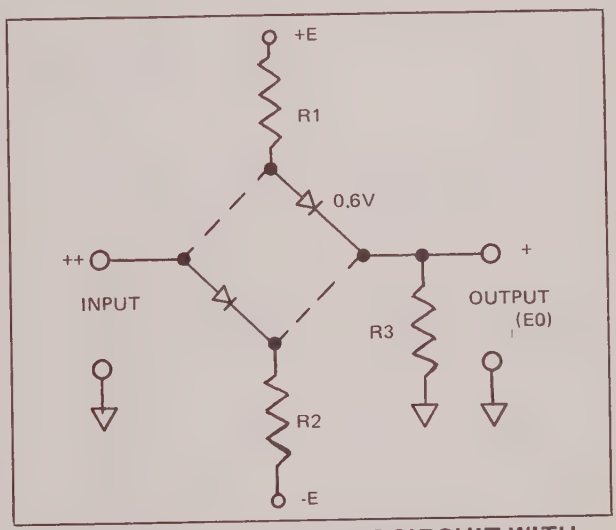


FIGURE 2-4 EQUIVALENT CIRCUIT WITH INPUT MORE POSITIVE THAN LIMIT

In the final circuit as used for the X-Y recorder (Dwg. 293230) note that back to back 10V zener diodes are used to prevent the operational amplifier from going into full saturation, increasing the speed with which it can recover from the limit condition.

4. When the limit switch SW-1 is in the 8 x 10 ("S" for SMALL) position, resistors R21 and R22 shunt R15 so that the limited signal is approximately ±3.5 volts instead of the ±5 volts used in the above discussion. This places the "X" limits, which were previously adjusted to just over ±7.5" of pen travel, to (3.5/5) x 7.5 or ±5.25" - suitable for an 11" sheet of paper.

This same reduction ratio works on the Y axis where ±5" travel is now reduced to (3.5/5) x 5 or ±3.5" of pen travel. (suitable for an 8½ " x 11" english or 8 ¼" x 11¼" metric graph sheet.) A single Hi/Lo limit adjustment is used for the smaller chart paper and is intended to keep the pen from going off the paper on to the table.

The limit switch and all adjustments can be reached when the preamplifier control panel is tilted open. The switch can be set for 'L' (large) or 's' (small) paper size.

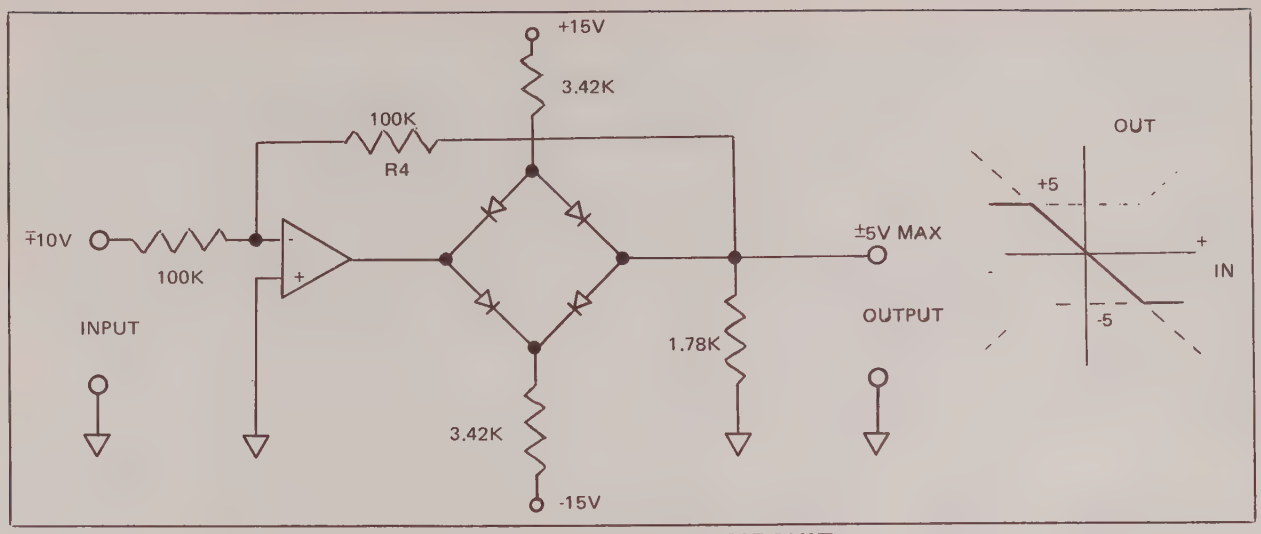


FIGURE 2-5 LIMITER CIRCUIT

2.5.5 Position Controls

The position controls are physically located on the preamplifier panel. Each panel unit consists of two variable pots with a clutch drive. With the knob in the normal spring loaded "OUT" position, only the "FINE" position tap varies from +10 volts to -10 volts. When depressed the clutch turns only the "coarse" tap from + to - while the "FINE" control remains where it was. The currents from these voltages are summed thru R9. The "fine" control will vary the pen position about ±4% F.S. while the coarse control will vary the pen about ±60% of full scale. The limiter circuit will prevent the pen from hitting the mechanical limits in the event that these controls are set too far.

2.5.6 Servo Error Amplifier Inputs

U2B (pins 1, 2 and 3) is a high gain error amplifier for the servo system. There are four inputs, discussed below, which are fed to pin 2 (minus input of U2B).

1. The output of the limiter circuit, ±5V, is applied to the summing junction (minus input of U2B) thru R16.

2. The slide wire output, positioned by the drive motor, is applied with reverse polarity (±10 volts approx.) thru buffer follower U2A (pins 5, 6 & 7) to R17. The current input to the error amplifier U2B from R16 can thus be bucked out by an equal but opposite current thru R17. Note that R17 is twice the value of R16 but the full scale voltages applied are in the same ratio. When the currents are equal but the opposite polarity, there is no error to amplify from these sources, and the motor drive stops.

3. A velocity signal is derived from the position signal taken from the slidewire. A portion of the output of U2A, controlled by the damping adjustment, R18, is fed thru an RC network consisting of C25 and R19 to the summing junction of U2B. This circuit provides a large bucking signal to the error correction amplifier for velocity changes in the pen position. This reduces or reverses the output, if necessary, in advance of an abrupt stop to reduce overshoot. (This may be an over simplification for those versed in servos but illustrates the action of this network in reducing overshoot.)

   Over damping produces a very gradual approach to the final position while underdamping (allowing some overshoot) can produce a final position more quickly.

4. The fourth input to the error amplifier is derived from the voltage output to the motor. A portion of the servo output, taken from the voltage divider formed by R28 and R24 is fed back thru a network which is a variable impedance depending on the frequency components in the waveform fed back. For very slowly changing outputs very little feedback is produced and the error amplifier has enormous amplification —

reducing the error between the signal input voltage and the slidewire position voltage to a few millivolts at most. This level of amplification at higher frequencies would cause instability and oscillation due to phase shifts, so the stabilizing network response to higher frequencies is tailored to match the stability requirements imposed by the mechanical mass being moved, motor characteristics, resonances and drive amplifier response.

2.5.7 Overdrive Protection

A transistor clamping circuit is used to protect the motor, mechanical drive and power output circuit from abuse.

Any mechanical restriction or other problem which causes a large continuing error signal at the output of U2B will cause the non-polarized capacitor formed by C19 and C20 to be charged thru R25. The time constant is approximately 1 second so that normal transient or ac error signals do not affect the driver output. If the C19/C20 voltage builds up above approx. 8 volts, either plus or minus, it will make one of two zener diodes conduct——turning on either Q1 or Q2. (Series diodes are used to prevent zener conduction with reversed polarity - as shown in the detailed circuit diagram). Q1 and Q2 are high gain darlington units which can effectively clamp the error voltage, applied thru R26, to circuit ground. This prevents the high power output stages, Q3 thru Q6, from operating. Resistors R29 and R30 are selected to allow a small amount of output to reach the power stages to drive the motor with a safe current it can tolerate continuously. This feature prevents the drive from going totally dead and permits the pen to gently return to its proper position when the condition is corrected. (effective also when locking in after switching from "STANDBY" to "OPERATE" condition. See following paragraph.)

2.5.8 Standby

A special connection is taken from R26 (in the overdrive protection circuit) to J5 pin 4. When this point is connected to circuit ground, available at J5 Pin 3, the drive amplifier output goes to zero. This produces a "STANDBY" condition. For common mode isolation reasons, a relay located on the misc. power board is used to make this connection when in STANDBY (OPERATE/ STANDBY panel switch not depressed). The relay can also be operated thru the remote input connector to prevent servo operation during remote setup procedures.

2.5.9 Power Supplies

All power supply components except the power transformer are located on the drive amplifier board. The power transformer has a shielded primary and shielded secondary to aid the common mode rejection. The 40 volt center-tapped output supplies two different bridge rectifiers. One of these supplies regulated + and - voltage for the power output stage and is fused on the board (Q7 and Q8 feed F2 and F1).

The X amplifier is regulated at ±20 volts, the Y board at ±10 by the differences in CR15 and 16, R41 and 42 shown in the tabulated items on drawing 293230. This is done to match the maximum pen velocities in the X and Y drives more closely.

The second bridge rectifier feeds VR1 and VR2 which regulate the + and - 15 volt supplies used for the operational amplifiers of the drive board and also the preamplifier thru the preamp connector J4.

The ±15 volt supplies also feed U3 to provide a precision ±10.000 volts used as a reference for the slidewire, pen position controls and preamplifier zero offset.

2.5.10 Misc. Drive Amp Circuits

Note that there are several "ground" circuits used in this drive amplifier but that they all connect eventually to the "Mecca" ground bus - a large foil area on the PC board tied to the power transformer center tap. This procedure isolates both signal currents for the operational amplifiers and precision reference from the large transient currents which flow in the motor drive circuits and those picked up on shields.

It is important to maintain isolation between the output (or regulator) transistors and their heatsink which is at chassis potential. This is done with insulating but heat conducting "sil-pads" and shouldered fiber washers. Any service on these parts should maintain the original isolation to minimize common mode problems.

The drive amplifier heat sink normally runs very cool to the touch when screwed to the chassis but should not be operated without the heat sink tied to the base plate (or equivalent) for more than 1 or 2 minutes.

2.6 MISC. POWER BOARD 894550

Refer to Schematic 294550

2.6.1 General

In addition to the drive amplifier isolated power supplies, the 305X X-Y recorder requires an isolated supply to power the optional time base unit, a high voltage supply for the electrostatic paper hold down, power for pilot indicator and table lighting, power for the pen lift solenoid and power for the logic used for remote control and time base control. All of these needs are satisfied by the Misc. Power Board in conjunction with an external transformer. In addition, the drive amplifier input signals are fed thru this board to the time base and the remote input jacks.

The power transformer supplies 12 volts ac, 400 volts AC and 35 volts center tapped AC from three separate windings to J-3 on the Misc. Power Board. The Miscellaneous Power Board also serves as a central distribution connector board to allow the separate harnesses and boards in the recorder to be easily removed if service is ever required. Considerable attention was devoted to modularizing the components for both manufacturing and service simplification.

2.6.2 12 Volt Winding

The 12 volt supply is protected by a 1 amp fuse on the board and is used as follows:

1. Exits via J-1 to the terminal block, TB-1, on the recorder base plate. Supplies 12 volts to the control panel pilot light for a "power on" indication and the fiber optic target light source for the recorder table assembly.

2. The 12 volts is rectified to approximately 15 volts dc by CR-1 and filtered by C-1. This voltage is used to supply the pen lift solenoid via J-2.

3. The +15 volts is regulated down to +5 volts by VR-1 and used as a logic level supply for the pen lift solenoid drivers, Q-1 and Q-2, and the remote controls of the time base.

4. The +5 volts is also used to energize the relays K1 and K2 which operate to place the drive amplifiers in "STANDBY". (Panel switch S-3 grounds J8 - Pin 2 or remote connector J9 Pin 5.)

2.6.3 35 Volt Winding

The center-tapped 35 volt power transformer output brought in on J-3 is passed straight thru on to J7 and is rectified, filtered and regulated in the time base. It is used to supply the operational amplifiers and reference voltage required. This voltage is sometimes tied to the X axis and sometimes to the Y axis by the time base selector switching. Therefore, no connection to other supplies is tolerable, unless intended.

2.6.4 400 Volt Winding

The 400 volts inputted at J-3 is converted to + and — 560V dc with respect to the 5 volt logic ground and used for the electrostatic hold down table. The table only requires a few microamperes at 1000V dc for holddown.

Resistors R4 and R5 limit the current from the supply at J3 (Pins 1 and 3), as well as eliminating the need for fusing. (Although the currents are small, two resistors are used to achieve the voltage rating required.)

J4 goes to the front panel control switch for the paper holddown. The 400V AC on Pin 3 is rectified into a + and — supply by the diodes mounted at the switch along with resistors to dissipate any charge on the table when the switch opens. Only small filter capacitors, C7, C4 and C5, are required because of the tiny currents involved. These, together with discharge resistors R6 thru R9 are mounted on the Misc. Power Board. Each side of the 1000 VDC passes thru a resistor pair, R10/R11 and R12/R13, on its way to the table HV connector J5. This provides additional current limiting.

NOTE 1: The pen driver circuit, Q1 and Q2, allows control of the pen down function by the time base, the front panel "PEN DOWN" switch, or the remote control inputs. When "PEN DOWN" is released, Q2 is biased off at its base through pin 6 of J8 and the pen will always remain in the up position. When "PEN DOWN" is depressed, the time base is in control of the pen (pin 16 of J7). If pin 16 of J7 is near +5V (time base off, reset, or disconnected) the pen will be up, if it is grounded (time base started) the pen will be down.

NOTE 2: Resistor R3 and Capacitor C3 are in parallel but in series with the output of solenoid driver U1. When no current is flowing (pen up) the voltage across C3 is zero. On a pen down command a full 15 volts is delivered to the solenoid while it pulls in and then the resistor limits the current when the capacitor charges up. This reduces the power required and the heating of the solenoid coil. A diode is used (near the solenoid coil) to suppress voltage transients.

NOTE 3: For remote pen control, remote pen enable (pin 7 of J9) must be grounded (pin 1 of J9) to enable Q1. Also, "PEN DOWN" on the control panel must be depressed to enable remote pen down functions.

NOTE 4: The external input jacks may be removed from the recorder and sold as an option by jumpering pin 1 to pin 3 where they connect at the Misc. Power Board. This connection is normally made by the tip switch on the jack and allows the phone plug to disconnect the preamplifier and substitute the external signal at this point.

NOTE 5: S1 is a manual switch which must be in the "IN" position when the time base is connected and "OUT" when it is not. The switch disconnects the jumpers from pin 19 to pin 20 and pin 14 to pin 15 on J7. The switches in the time base ("X", "Y" or "OFF") control whether a ramp signal or preamp output is fed back to the driver amplifier input. When the time base is out and the switch is "out" the preamps are connected directly to the drive amps through S1.

2.7 TIME BASE (DIGITAL)

Refer to Figure 2-6, Simplified Timebase Circuitry, and Schematics 294433 and 294434.

The time base consists of 2 boards in the front panel module, and is plugged into the Misc. Power Supply Board (894550).

2.7.1 General

The time base, 894451 (or time base retrofit), is an option designed to be compatible with the 305X series X-Y Recorder line. It consists of two p.c. boards in the front panel module and connects to the Miscellaneous Power Board, 894550.

The time base has six sweep rates which are selected by the front panel pushbuttons, and can be put on the X or Y axis. The "Start" button drops the pen, if "PEN DOWN" (on the control panel) is depressed and starts the sweep. "Reset" will lift the pen and return it to its starting point. If the pen is not reset during a sweep, it will reach a point set by the "End of Sweep" knob on the front panel, lift the pen and automatically return it to its starting point. "End of Sweep" will span approximately 20% to 100% of the chart. If "PEN DOWN" is not depressed the pen will not be lowered.

External control of the time base is also possible through the remote connector of the X-Y Recorder with TTL signals or contact closures. "Start" and "Reset" are the only time base functions possible through the remote connector.

The circuitry of the time base consists basically of a programmable clock which, when enabled, increments a counter. The counter addresses a digital to analog (D/A) converter producing a staircase (ramp) voltage which goes to the drive amp selected. The sweep rate selected determines the slope (rate of change) of the staircase voltage. The amplitude of each step in the staircase is very small and cannot be detected at the pen output (.004"). The end of sweep is controlled by a comparator U3 on the D/A board. The comparator compares a fixed point set by the "End of Sweep" knob on the front panel to the position feedback resistor selected in the X-Y Recorder.

2.7.2 Detailed Description

The main clock for the time base, U1 of the Clock Board, is a voltage to frequency converter. Depressing "X" or "Y" selects a voltage from a

voltage divider (U-6, R1 and R2, D/A board) to set the necessary main clock frequency. The main clock output (TP4) then goes to an enable circuit U2-D.

When the "Start" button is depressed a clock pulse goes to pin 11 of U-4B. This clocks in a HI output (+15V) at Q (pin 9) and enables the clock at U2-D. The main clock signal then goes to a series of dividers. U-4A divides by two and U-3 provides a dual divide by ten. This makes it possible to divide by 1, 2, 10, 20, 100 and 200 to provide our six sweep rates.

The divided clock signal (TP3) then proceeds to a counter, (Pin 10 of U-2, D/A board), which addresses a digital to analog converter (D/A) U-1. Each clock pulse increments the counter which increases the analog output of the D/A in a stair-case fashion. The output of the D/A is amplified by U-4 and the ramp voltage (TP2) then proceeds to the X or Y drive through the "X" or "Y" push-buttons.

The "X" or "Y" axis selection buttons and "Off" are interlocking buttons and route many signals. When "Off" is depressed, the X and Y preamps will be connected to their drive amps, the time base will be reset and the time base pen control disconnected. When "X" is selected, the Y preamp will be connected to the Y drive amp, the time base will be connected to the X drive amp, and the X position feedback and ground will go to comparator U-3 on the D/A board. Similar connections occur when Y is selected.

The comparator (U-3) compares the ramp from the position feedback resistor to a fixed setting from the "End of Sweep" control on the front panel. When the position feedback signal is equal to the End of Sweep setting, pin 7 of U-3 will go low and will clear U-4B (Clock Board). This will disable the clock at U2-D and stop the sweep. If "Auto" reset is selected when the comparator goes low, U2-A will invert the signal and reset the counter, U2 at pin 11 and the pen will return to its starting point. The "Reset" button also goes to U2-A to reset the counter and clears U4-B to disable the clock at U2-D (pin 12).

There is an LED on the time base front panel which indicates that the X or Y axis is selected and that one of the preamps is disabled. It it turned off by the "OFF" button.

If the "PEN DOWN" button on the control panel is depressed, the pen will be lowered when "Start" is depressed. Pin 9 of U4-B will get clocked high, turning off Q-1 and U-5 (Clock Board). This will leave pin 5 of J-1 high (+5V). When "Reset" is depressed or end of sweep is reached, U4-B will be cleared, Q-1 will be biased on, U5 biased on and pin 5 of J-1 will be pulled to the TTL ground, raising the pen.

Provisions for external TTL controls of the time base have been made and are all photo-isolated from the time base through U5, U6, and U7 of the Clock Board.

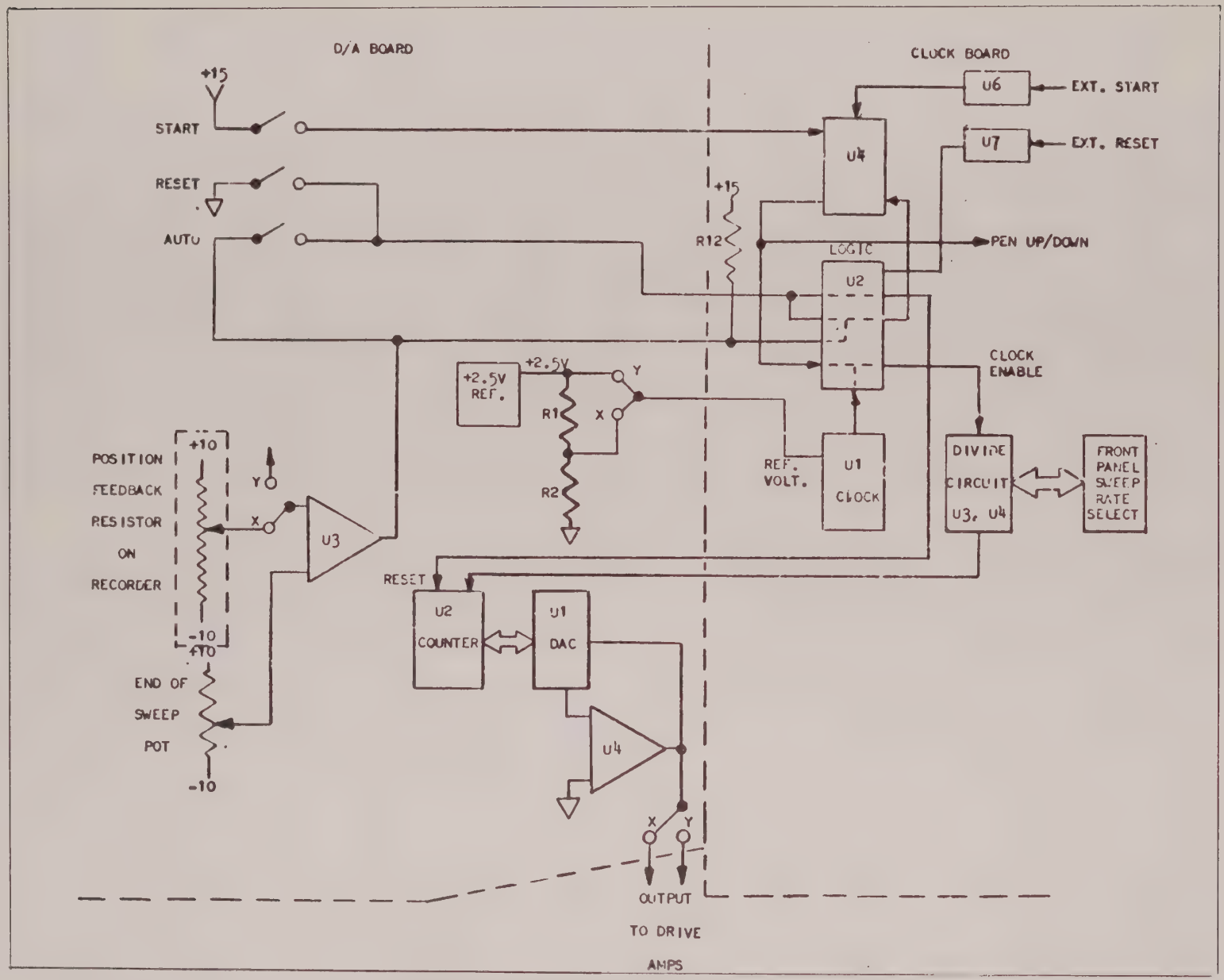


FIGURE 2-6 TIMEBASE CIRCUITRY, SIMPLIFIED (DIGITAL)

SECTION III

CALIBRATION

3.1 GENERAL

The Gould 305X X-Y recorder is calibrated at the factory to insure optimum performance. However, calibration may be required when parts are replaced. This section describes and illustrates the procedures necessary to calibrate the recorder, including preamplifiers and timebase. Calibration should be performed by qualified personnel only.

NOTE: This procedure is broken down into steps by individual adjustments. After repair of the unit or some other change in the electronics, it is necessary only to recalibrate those circuits affected by the change.

3.2 TEST EQUIPMENT REQUIRED

The following list of test equipment is recommended for calibration of the recorder, preamps and timebase. All equipment may not be required for each unit.

NOTE: Specific manufacturers need not be adhered to, but any equipment used must have the same or better specifications.

Digital Voltmeter: Data Prec. 3500 (Keithley 179A) or equivalent.

DC Reference Source: Digitec Model 3110 or equiv.

Function Generator: Wavetek Model 142 or equiv.

Frequency Counter: HP Model 5315A/B or equiv.

Screwdriver for phasing adjustment - insulated 1/8" drill rod with blade tip.

Access and switch connectors: Gould Nos. 294998-20 and 294999-20.

3.3 PRELIMINARY SET-UP

Connect recorder to proper power line. No other cables or leads should be connected to the recorder at this time, either to the front or rear panel. Open the front panel. Section 4.4 in the operator's manual provides instructions, if required.

WARNING: EXPOSED HIGH VOLTAGE WILL BE PRESENT INSIDE THE UNIT.

Figure 3-1 shows views of the recorder with the front panel open, and locates various internal controls used in calibration. A small, insulated screwdriver is required to adjust these controls.

Disconnect the cable assemblies from the Drive Amplifier input connectors (Drive Amp J4, shown on Figure 3-1). Insert the access and switch connectors, Gould part numbers 294998-20 and 294999-20, into J4 (access pins nearest the Drive Amp and pointing up), and re-connect the cable to this assembly. This device provides a convenient place to attach probes, etc. to any pin in J4 and also allows one to selectively open any lines in the cable - very handy for troubleshooting. Figure 3-2 shows how the assembly is inserted and where each pin number is available.

3.4 VOLTAGE CHECKS

Turn power on per section 3.3.1 in the Operator's manual. Measure the voltage present across the two pins of Drive Amp J4 given in the table. It should be within the tolerances shown.

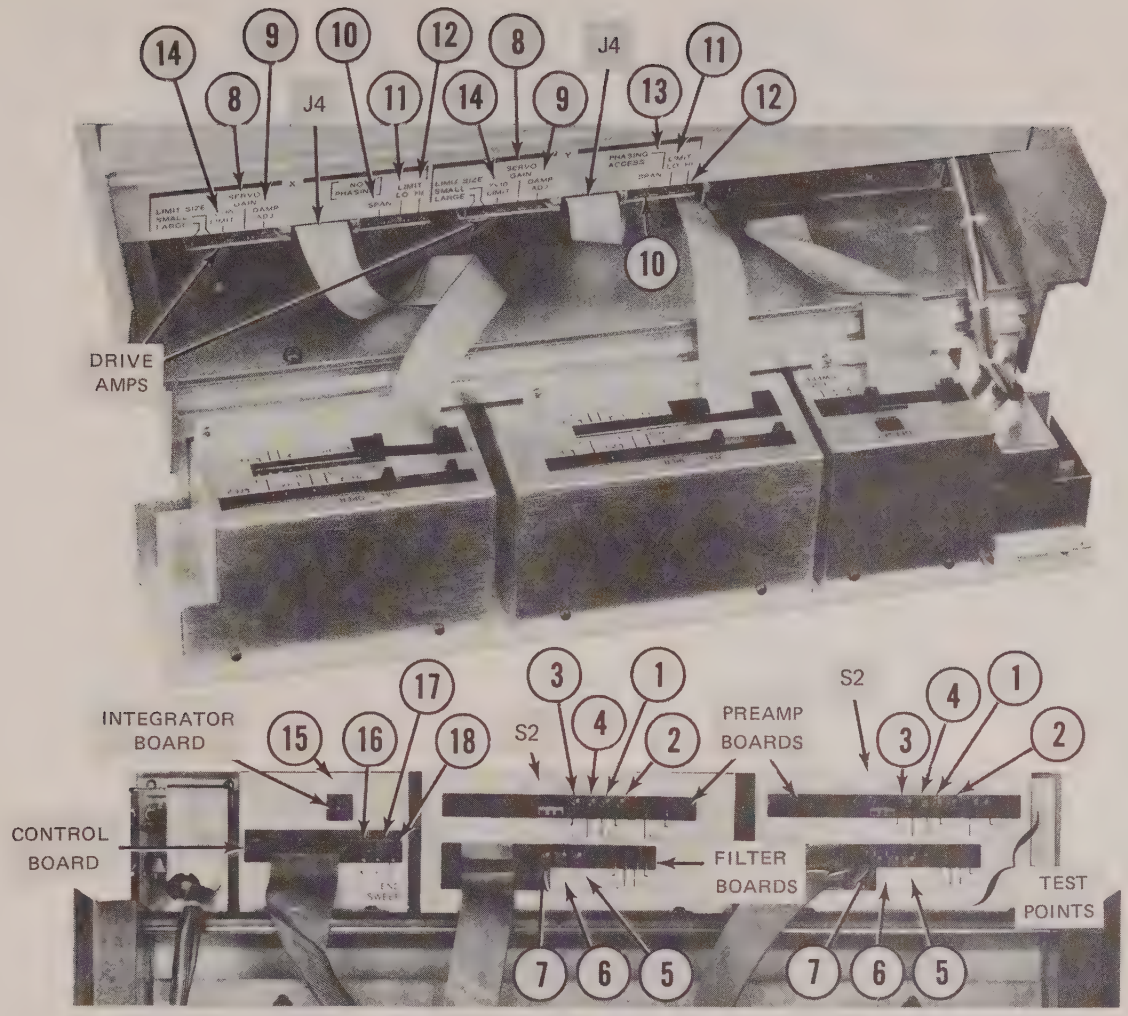
Signal Pin	Ground Pin	Voltage	Tolerance
1	3	+15VDC	±0.6VDC
2	3	-15VDC	±0.6VDC
19	17	+10VDC	±0.005VDC
20	17	-10VDC	±0.005VDC

3.5 PAPER ALIGNMENT LIGHTS AND HOLD DOWN CHECK

Place on the table a sheet of standard 11" x 16½" chart paper, Gould part number 11-2913-34, 35, 37 and 38. All six fiber optic target lights should be easily visible in a reasonably lighted room when viewed through the chart paper from directly above. Center the sheet using the lights and depress the PAPER HOLD button. The paper should immediately flatten down with a little hand smoothing.

3.6 PEN DOWN PANEL CONTROL CHECK

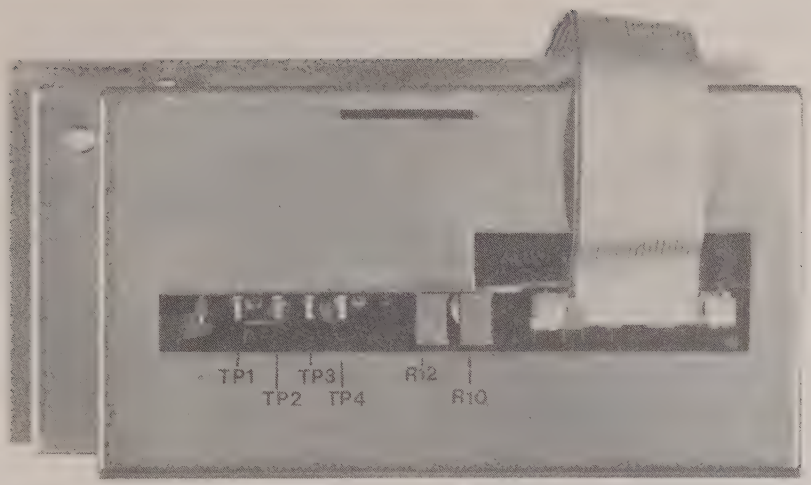
When button is "in" solenoid should pull in and pen should be able to write. When button is released the pen should lift. Try this several times at 5 to 10 second intervals. Button should not bind or stick nor should relay not activate or not release. With paper in place make certain the pen has adequate up and down motion to both write and not write in all four quadrants of the chart. If required, check and adjust per the following procedure:



REF NUMBER	DESCRIPTION	PANEL MARKING
1	Preamp Offset	R6
2	Bias Adjust	R4
3	Inverter Offset	R13
4	Inverter Gain	R10
5	Zero Offset	R8
6	Zero Gain	R7
7	Preamp Gain	R12
8	Servo Gain	SERVO GAIN
9	Damping Adjust	DAMP ADJ

REF NUMBER	DESCRIPTION	PANEL MARKING
10	Span	SPAN
11	Low Limit Both X & Y	LIMIT LO
12	High Limit Both X & Y	LIMIT HI
13	Phasing (Y-Axis Only)	PHASING ACCESS
14	Single Limit Adjustment For 8½" x 11" Paper	7 x 10 LIMIT
15	Timebase Offset	OFFSET
16	Sweep Rate - X	X
17	Sweep Rate - Y	Y
18	End of Scan Limit	END SWEEP

FIGURE 3-1 3054 INTERNAL CALIBRATION CONTROLS AND TEST POINTS



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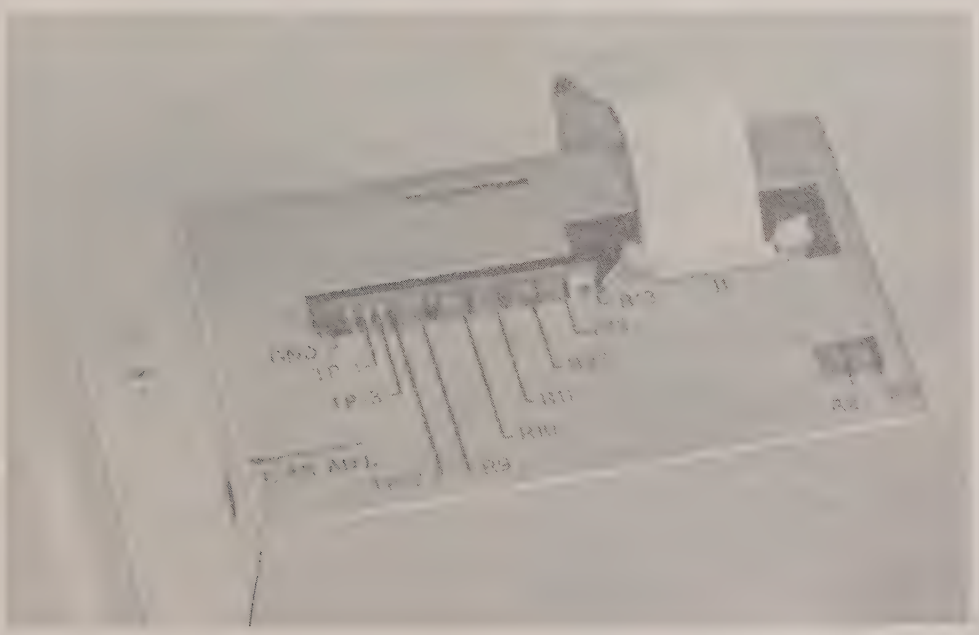
PANEL MARKING	DESCRIPTION
TP1 TP2 TP3 TP4	Test Points. See Schematic 294005 and STAR DIAGRAM, Figure 4-2
R10	PREAMP GAIN
R12	PREAMP OFFSET

FIGURE 3-1A 3052 PREAMP CALIBRATION CONTROLS AND TEST POINTS



R2	R3	R9	R10	R11	R12	R13	R26
Attenuator	Preamp Offset	Preamp Gain	Offset	Filter Offset	Zero Gain +	Zero Gain–	Inverter Gain

FIGURE 3-1B 3056 PREAMP CALIBRATION CONTROLS AND TEST POINTS

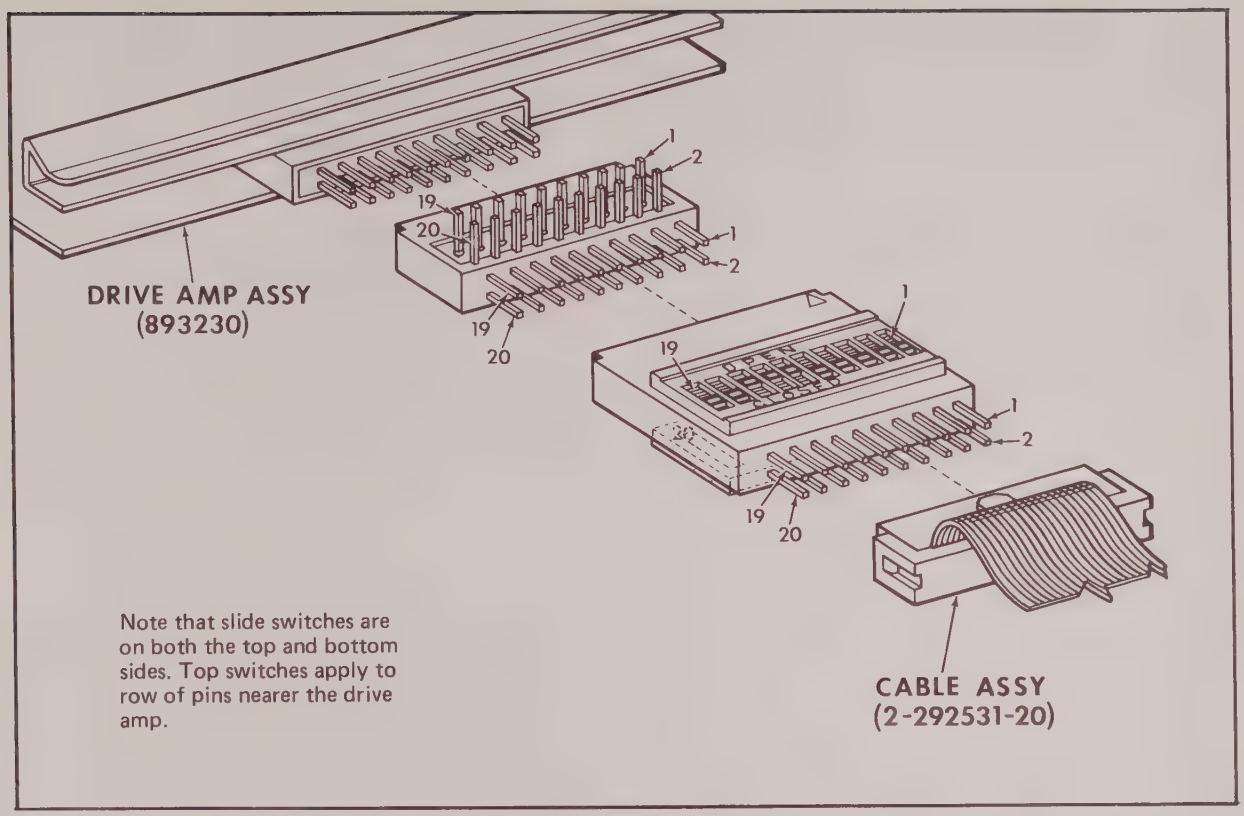


FIGURE 3-2 ACCESS AND SWITCH CONNECTOR ASSEMBLY

PEN LIFT ADJUSTMENT PROCEDURE

The adjustment consists of moving one or both "racks", small plastic parts with internal gear teeth, which support the shaft assembly (Gould part number 694418) that moves up and down to lift the pen. The racks have slotted holes for adjustment. The Front Rack Gould part number 394425, is the one most likely to have been unintentionally moved and hence probably the only one needing adjustment. The Rear Rack is Gould part number 394426.

Check for proper alignment as follows:

a. Install an 11 x 16½ sheet of Gould chart paper.

b. The pen should be up (PEN DOWN pushbutton released).

c. Using the PEN POSITION controls, move the pen over the full writing range: from full top to full bottom (Y-axis) at several different X-axis positions. The pen should never touch the paper. (Specifications state a minimum clearance of 0.040 inches. A standard size paper clip used as a spacer approximates this measurement.) Adjust the racks as required.

d. Lower the pen by depressing the PEN DOWN pushbutton. Note that the pin, which slid on top of the 694418 shaft assembly when the pen was up, and which is attached to the ink cartridge via a shaft assembly, should now be raised just off the shaft assembly.

e. Move the pen over the full writing range as done in step c. The pin should never contact the shaft assembly. (Specified dimension: 0.005 inch.) Adjust the racks as required.

f. Repeat steps c, d and e until no further adjustment is required.

3.7 "X" & "Y" SERVOS FUNCTION CHECK

Approximately center the coarse PEN POSITION adjustment for both axes via front panel position pots. Preset all limiter adjustments to prevent off scale operation i.e. HI LIMIT CCW (20 turn adj), LO LIMIT CW (20 turn adj) and LIMIT SIZE switch to LARGE (to the left). Set SERVO GAIN adjustment approximately 10 turns CCW from clockwise position. Set DAMP ADJ. at approximately center (10 turns from either end). Leave the pen in the up position for now and gnd the input signals on the front panel.

CAUTION: BEFORE MOVING PEN MANUALLY, MAKE CERTAIN THE STANDBY/OPERATE SWITCH IS IN STANDBY (RELEASED, FULL OUT POSITION). ALSO, THE CARRIAGE MUST ALWAYS BE GRASPED NEAR THE UPPER END WHEN MOVING IT BY HAND.

Move the pen to a corner of the chart area with your hand and press the OPERATE button. The pen should GENTLY move to the center area and lock into position. Place unit in STANDBY and move pen to opposite diagonal corner and press the OPERATE button. The pen should again GENTLY move to the center area and lock into position. Also check that the pen moves in response to the "X" and "Y" fine and coarse POSITION Pots. (Press in knob for coarse).

3.8 CHART TABLE ALIGNMENT

With the "X" POSITION control set the pen to the left edge of the chart and with the "Y" POSITION set the pen to the center of the chart (Approx #5). Trace a horizontal line on the paper (Pen Down, move "X" POSITION). If this line is not parallel (within .005 inches per 12" of motion) to the paper horizontal grid lines the table must be re-adjusted by loosening the 4 edge screws and the top and bottom center screws and rotating the table. Remember the paper must be exactly aligned with target lights. Also note that this adjustment may upset any electrical limit calibration and therefore should be done before adjusting limits. The top and bottom center screws work with Floating nuts which can be loosened enough to allow more than adequate adjustment of the table. Always re-check the alignment after tightening.

The "Y" axis has been mechanically preset at 90° (perpendicular) to the "X" axis. Check this by drawing a vertical line at center of "X" axis (approx. 7.5). Use coarse "Y" POSITION control and examine the trace for a maximum skew of .005" in 8" of travel.

3.9 10" x 15" GRID LIMIT CALIBRATION

Turn the coarse PEN POSITION control on each channel to the CCW stop. The pen should go to a position near 1 on the "X" axis and 1 on the "Y" axis (1, 1) which represents the in most end of the limit pot adjustment, assuming the paper on the table has been adjusted properly to the target light markers on the table. Turn the LO LIMIT adj. pot CCW on each amplifier until the pen is approximately 1 division (0.1") outside of the chart grid. The pen will move about 1.2" and require about 15 turns of the 22 turn pot. At this position the pen should still be over 0.1" from the mechanical "X" and "Y" stops. Reset table location to equalize spacings to "O" - ring bumpers if necessary.

Reset both PEN POSITION pots to a full clockwise position. The present limits should be at approximately 14 on the "X" axis and 9 on the "Y" axis. This is the in most adjustment for the HI LIMIT pots. Adjust the HI LIMIT pots clockwise (approximately 15 turns on each amplifier) to set the pen to a position approximately 1 division outside of the chart grid (approximately 0.1").

3.10 7" x 10" GRID LIMIT CALIBRATION

Unlatch the PEN DOWN and PAPER HOLD buttons and substitute an 8½" x 11" sheet of paper with a 7" x 10" grid. The left edge of the sheet is lined up with the two target lights located 3½" above and below the center line. The Grid Center "X" axis is aligned using the two center target lights. Set PEN POSITION controls to full CCW for "X" and "Y" axis. Place the LIMIT SIZE switch to the SMALL side (to the right) on both amplifiers. Adjust the 7 x 10 LIMIT pots so the pen is between the corner of the paper and the corner of the GRID. Set the PEN POSITION pots to full clockwise and check that the pen is within the right hand and top margins but outside of the grid. Return the LIMIT SIZE switch to the normal LARGE (left hand) position.

NOTE: Limit calibration using 10" x 15" Grids should be perfectly adequate for 25cm x 38cm grids (25cm x 38cm is equal to 9.84" x 14.96")

3.11 DAMPING ADJUST CALIBRATION, COARSE

Set STANDBY-OPERATE switch to STANDBY, to by-pass the electrical limits.

Connect DVM positive lead to J4 pin 7 which is the Slidewire Buffer output and the negative lead to pin 17 of J4 which is 10v Ref. Gnd. Move pen assy arm to right. You should read approximately $+10\ ^{+0}_{-.3}$ VDC. Move pen assy arm left and the reading should be $-10\ ^{+0}_{-.3}$ VDC. Disconnect DVM. Connect Function Generator to pin 13 of J4 and pin 11 of J4 (GND). Set Function Generator Amplitude at minimum. Set mode to square wave output and frequency to 0.5 Hz. Set the recorder STANDBY-OPERATE switch to OPERATE. Move pen to chart center using PEN POSITION controls.

If unit has the time base option, select opposite channel to which you are putting signal into and select that channel on your time base. Increase amplitude to check overshoot condition. Adjust DAMP ADJ for slight overshoot at about 80% of full scale pen motion on 4 volts peak-to-peak. Over shoot will be precisely set later.

If unit does not have time base use PEN POSITION control on front panel to move pen after pen has hit peak of signal. You should be able to adjust damping for slight overshoot at about 80% of full scale pen motion or 4 volts peak-to-peak. Overshoot will be precisely set later. Shut off the Input Signal.

3.12 DEADBAND CALIBRATION

Turn up gain (SERVO GAIN POT CCW) until oscillation occurs and then backoff (CW) ½ turn beyond where oscillation stops. DO NOT advance the gain again even though it seems stable a turn or two higher (CCW). DO NOT allow violent oscillation to continue for any length of time.

3.13 DAMPING ADJUST CALIBRATION, FINE

Following same procedure as for coarse adjustment, adjust for less than 1% overshoot with a 10" square wave (0.1 inch). DO THIS FOR BOTH THE "X" AND "Y" AXIS.

3.14 SPAN ADJUSTMENTS (ASSUMES 15 MINUTE WARM-UP)

Check paper alignment. Short pin 11 (GND) of J4 to pin 13 (signal) of J4. Set PEN POSITION ("X" and "Y") to chart center ("X" = 7.5 and "Y" = 5 for 15" x 10" Grid). Apply -2.500 volts to pin 13 of J4 (pin 11 GND) on both "X" and "Y" axis and adjust "X" and "Y" SPAN controls to place pen exactly at 0, 0 on the chart. Now apply +2.500 volts to both axis and pen should move to opposite corner (15.0, 10.0). Repeat the previous steps adjusting pen position slightly (if required) to obtain best corner accuracies.

3.15 PHASING ADJUSTMENT

Connect a 3 to 2 Divider, consisting of a 1000 ohm resistor in series with a 2000 ohm resistor as shown in Figure 3-3, to the function generator. Set the generator on sine wave output at approximately 5V peak-to-peak and 0.1 Hz. This should produce a 10" excursion in both the X and Y direction if the pen is centered at zero input ("X" = 7.5 in., "Y" = 5 in). Gradually increase the signal frequency to 1.0 Hz.

The phasing control pot, on the Y drive amp only, is located between the SPAN and the LO LIMIT controls and is recessed about one inch behind the other pots. Adjust it for Zero Phase Shift (a straight line with minimum open loop visible) at the 1Hz setting. The adjustment is purposely made difficult to reach, even with the special 1/8" diameter screwdriver. Proper phasing should always be checked by writing a 14 inch long line at 45° (10" on each axis). Less than .062" separation in the loop should be obtained at 0.7 Hz after calibration.

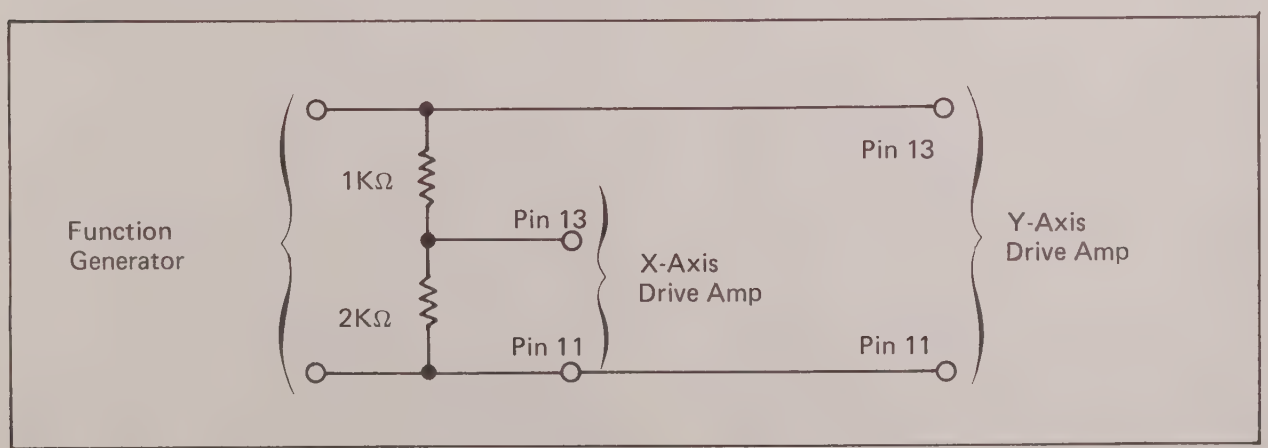


FIGURE 3-3 PHASE ADJUST CIRCUIT

3.16 PREAMP BOARD CALIBRATION X AND Y AXIS (3052 and 3054 only)

Do X axis, then repeat for Y axis. Install both X and Y preamps. Place a short across HI and LOW INPUT terminals on the front panel. Move switch S2 (See Fig. 3-1) on preamp board (893707-Top) to closed (CAL.) position (towards the Ribbon Cable Connector). Set the Front Panel switches as follows: INPUT RANGE switch on .5mv/in or 0.2mV/cm (x1 mode), ZERO OFFSET*OFF, and unit in STANDBY. Place the + lead of the DVM on TP-1. (See Fig. 3-1, preamp Bd). Place — lead on TP-5 of the filter board (893708 - bottom). Adjust preamp offset R-6 so the DVM reads 0±1mv. NOTE READING. Move switch S2 to OPER (open) position (away from the Ribbon Connector). Adjust Bias adjust R-4 until the DVM reads the same as previously measured ±0.5mv. Move DVM + lead to TP-2. Adjust INVERTER offset R-13 to same voltage as previously read on TP-1. Put the x100 switch in x100 (depressed). Remove short and apply +5.00 volts to the input. Move the DVM + lead to TP-1. NOTE READING. Move DVM + lead to TP-2. Adjust R-10 Inverter Gain so the voltage at TP-2 is at the same level as TP-1. NOTE: It will be opposite in polarity.

3.17 3054 FILTER BOARD CALIBRATION - Y AXIS

Using Y axis PEN POSITION control place pen on Lower Chart edge (Y = 0). On preamp front panel select the 1mv/in (.5mv/cm) range and x100 range. INPUT switch should be in NORM position. Apply a +1.000 (+1.250 metric) volt signal to preamp and adjust R-12 to put pen at top of the chart. Move DVM + lead to TP-3 and — lead to TP-5 and adjust R-8 for 0.000 ±1mv. Now apply a +5.000 (+6.250 metric) volt signal to preamp. Turn ZERO OFFSET ON and select 500% range. Adjust R-7 until pen is at lower edge of the chart (Y = 0).

3.18 3054 FILTER BOARD CALIBRATION - X-AXIS

Using X axis PEN POSITION control, move pen to left edge of chart (X = 0). On preamp front panel select 1mv/in. (.5mv/cm) range and x100 mode. The INPUT switch should be in the NORM position. Apply +1.500 (+1.900 metric) volts to preamp. Adjust R-12 to put the pen on the right edge of the chart. Move DVM + lead to TP-3 and — lead to TP-5. Adjust R-8 for 0.000 ±mv. Now apply +7.500 (9.500 metric) volts to preamp. Turn ZERO OFFSET ON and select 500% range. Adjust R-7 until pen is at left edge of chart (X = 0).

*Not applicable to 3052 models.

3.19 3056 PREAMPLIFIER CALIBRATION - X-AXIS

1. X-Axis Calibration Procedure.

   NOTE: All voltages in parenthesis are for metric units.

a. Turn the Y-Axis preamp "OFF". On the X-Axis preamp turn the zero offset to "OFF", filter "IN", and select "Invert", input range "OFF". Mount and align mylar calibration chart PT 3835, 3836.

b. Connect low input terminal to guard. Connect "Low" and "Hi" input terminals together using a Copper shorting bar.

c. Apply DVM "High" lead to TP-1 and "Low" lead to GND on input range. Select 2.5mV/inch (1.0mV/cm) range, X1 mode and "ON". Adjust R11 on filter board (lower board) for 0.000 volts ±250 microvolts.

d. Move DVM "High" lead to TP-2. Adjust R-10 for 0.000 Volts ±3mV.

e. Put "High" lead of oscilloscope to TP-2 "Low" to GND. Select .025 mV/inch (.01mV/cm) range. Adjust R3 on the preamp (top) board for 0.000 Volts ±5mV.

f. Select 5.0mV/inch (2.0mV/cm) range. While changing the mode switch from X1 to X1000 then back to X1, etc. Adjust the "Bias Adjust" on the preamp board so the output (TP-2) does not change by more than 5mV between the two modes of operation.

g. Repeat steps e and f and check for interaction of controls, readjust if necessary.

h. Select 1.0mV/inch (.5mV/cm) range, "X-1" mode. Remove Copper shorting bar. Connect DC-Voltage source. Set voltage source to 0.000 volts. Using X-axis pen position adjust pen on the "X-Zero" line of the mylar cal. chart. Apply +15mV (+19mV) to input. Adjust R9 on filter board so pen stops on X-Cal line.

i. Set DC voltage source to 0.000 volts. Select "NORM" input. Use pen position to readjust the pen on the X-Zero line if necessary. Apply -15mV (-19mV) to input. Adjust R-26 on filter board so the pen stops on the X-Cal line.

j. Apply +150mV (+190mV). Turn zero offset "ON" and select "+" and "1000%" offset. Adjust R-12 on filter board so pen stops on the X-Zero line.

k. Apply −150mV (−190mV). Select "−" zero offset. Adjust R-13 on filter board until pen stops on the X-zero line.

l. Turn zero offset "OFF". Select 5mV/inch (2mV/cm) range, X-1000 mode. Apply +75 volts (+76) and adjust R-2 on preamp board until pen stops on the X-Cal line.

3.20 3056 PREAMPLIFIER CALIBRATION - Y-AXIS

a. Turn X-axis "OFF". On Y-axis turn zero offset "OFF", filter "IN", and select "Invert", input range "OFF". Mount and align mylar calibration chart PT 3835, 3836.

b. Connect low input terminal to guard. Connect "Low" and "Hi" input terminals together using a Copper shorting bar.

c. Apply DVM "High" lead to TP-1 and "Low" lead to GND on input range. Select 2.5mV/inch (1.0mV/cm) range, X1 mode and "ON". Adjust R11 on filter board (lower board) for 0.000 volts ±250 microvolts.

d. Move DVM "High" lead to TP-2. Adjust R-10 for 0.000 volts ±3mV.

e. Put "High" lead of oscilloscope to TP-2 "Low" to GND. Select .025mV/inch (.01mV/cm) range. Adjust R3 on the preamp (top) board for 0.000 volts ±3mV.

f. Select 5.0mV/inch (2.0mV/cm) range. While changing the mode switch from X1 to X100 then back to X1, etc. adjust the "Bias Adjust" on the preamp board so the output (TP-2) does not change by more than 5mV between the two modes of operation.

g. Repeat steps e and f and check for interaction of controls, readjust if necessary.

h. Select 1.0mV/in. (.5mV/cm) range, "X-1" mode. Remove Copper shorting bar. Connect DC-Voltage source. Set voltage source to 0.000 volts. Using Y-axis pen position adjust pen on the "Y-Zero" line of the mylar cal. chart. Apply -10mV (-12.5mV) to input. Adjust R9 on filter board so pen stops on Y-Cal line.

i. Set DC voltage source to 0.000 volts. Select "NORM" input. Use pen position to readjust the pen on the Y-Zero line if necessary. Apply +10mV (+12.5 mV) to input. Adjust R-26 on filter board so the pen stops on the Y-Cal line.

j. Apply +100mV (+125mV). Turn zero offset "ON" and select "+" and "1000%" offset. Adjust R-12 on filter board so pen stops on the Y-Zero line.

k. Apply −100mV (−125mV). Select "−" zero offset. Adjust R-13 on filter board until pen stops on the Y-Zero line.

l. Turn zero offset "OFF". Select 5mV/inch (2mV/cm) range, X-1000 mode. Apply +50 volts and adjust R-2 on preamp board until pen stops on the Y-Cal line.

3.21 3056 PREAMPLIFIER CALIBRATION - MISCELLANEOUS

On both axes select 1mV/inch (.5mV/cm) range, X-1000 mode. Apply a .7 Hz sine wave to both axes. Adjust amplitude of an A.C. voltage source so a line travels the entire length of the Y-axis chart. Adjust the "Phasing Adj" on the Y-axis servo board until both upward and downward traces overlap and no space can be seen between traces.

Over Voltage Check

a. Turn time base and Y-axis preamp "OFF".

b. Apply +250 VDC to the "High" and "Low" input terminals of the X preamp. Push all switch positions on the front panel while voltage is applied. Remove 250 VDC. Turn axis "OFF". Set pen to left chart edge using pen position. Turn axis "ON". Select 1mV/inch (.5mV/cm) range, X1 mode, normal, no zero offset. Apply +15mV (+19mV) and make sure the pen travels full scale and preamp is still functional.

c. Turn off X-axis, repeat step b for the Y-axis applying +10mV (+12.5) in place of +15mV (+19mV) in step b.

NOTE: Do not leave the high voltage applied more than 15 seconds. To do so would allow the preamp to heat up internally causing the pen to shift. If this occurs the unit must be allowed time to cool.

3.22 3056 MISCELLANEOUS POWER BOARD CALIBRATION (894550)

a. Mount and align calibration test chart (PT 3835 English; PT 3836 Metric).

b. With the recorder in STANDBY MODE place the pen halfway between the upper chart edge and electrical limit markings for both axis (up and right).

c. Connect DVM "LO" to TP2 and "HI" to TP1. Adjust Y-FB pot R17 so DVM reads +8.000 VDC ±1mV.

d. Connect the DVM "LO" to TP4 and "HI" to TP3. Adjust X-FB pot -R18 so the DVM reads 8.000 VDC ±1mV.

3.23 TIMEBASE CALIBRATION

a. Select the Y-axis and a sweep rate of .5 sec/inch (.25 sec/cm). Have the "AUTO" button released and the "END OF SWEEP" knob on the front panel fully clockwise (in detent).

b. Connect DVM "LO" to TP1 (GND) and "HI" to TP2, push reset and adjust "OFFSET" pot (R4) to 0.0000V ±.1mV.

c. Connect DVM "LO" to TP1 (GND) and "HI" to TP5; adjust R3 so that DVM reads 8.000 VDC ±1mV.

d. Set Sweep Rate:

1. Set time base to Y-axis and .5 sec/inch (.25 sec/cm).

2. Measure V ref: Connect DVM "HI" to R6 on top board on the end toward the switches and DVM "LO" to TP1 (GND). V ref should be 6.25 V ±.3215 Volts. (NOTE: R6 is a 10K and next to it is a 4K).

3. Connect frequency counter at TP4 and TP1. "RESET" and "START" timebase, and with timebase still sweeping, set frequency (adjusting R6 on bottom board) to:

$\frac{4096}{Vref}$ for English units,

$\frac{3276.8}{Vref}$ for Metric units.

Repeat sweep to check frequency setting.

3.24 PEN TIP PRESSURE

Measure the force required to just lift the pen tip off the chart paper. It should be 13 to 15 grams. To adjust, move the small arm, item 18 on Figure 6-13, which will vary the spring tension. See Paragraph 5.7.3.

3.25 MECHANICAL ADJUSTMENTS

Any required mechanical adjustment instructions, such as setting cable tension, are described in Section V, REPLACEMENT OF ASSEMBLIES.

SECTION IV

TROUBLESHOOTING

4.1 GENERAL

This section contains a troubleshooting table to assist operating or maintenance personnel in isolating malfunctions which may occur during normal operation of the Gould 305X X-Y Recorder.

Also included in this section is a "STAR" diagram to further aid troubleshooting. This is explained in Paragraph 4.3.

Please refer also to Section II THEORY OF OPERATION, Section V REPLACEMENT OF ASSEMBLIES, Section VI PARTS IDENTIFICATION and the schematics in the appendix section. Also, Paragraph 3.3 describes a useful Troubleshooting aid: a special Drive Amp cable connector.

For servicing beyond the scope of the instructions contained in the manuals or the technical equipment available, contact your nearest Gould Service Engineer listed on the warranty card shipped with the recorder.

4.2 TROUBLESHOOTING TABLE

All malfunctions are listed in sequence. Be sure to check all steps in sequence to isolate a malfunction.

ELECTRICAL POWER MALFUNCTIONS

MALFUNCTION	CAUSE	REMEDY
1. Plotter inoperative (power lamp not illuminated when power switch is depressed.	a. Unit not connected to power source.	a. Connect unit to applicable power source.
	b. Main fuse blown.	b. Replace fuse after correcting malfunction.
	c. POWER switch not making contact.	c. Replace POWER switch.
2. Chart paper slides on writing table.	a. Misc. Power Transformer defective.	a. Replace transformer.
	b. PAPER HOLD switch defective.	b. Replace switch.
	c. Diodes CR1 or CR2 (on PAPER HOLD switch) defective.	c. Replace diodes.

TRACK ASSEMBLY MALFUNCTIONS

MALFUNCTION	CAUSE	REMEDY
1. No movement in the X-axis.	a. X-axis cable assembly defective.	a. Replace cable assembly.
	b. Foreign object lodged on carriage track.	b. Remove foreign object.
	c. Defective motor	c. Replace motor.
	d. Defective preamplifier module.	d. Repair or replace preamplifier module.

MALFUNCTION	CAUSE	REMEDY
	e. Fuses blown on drive amp board.	e. Replace fuses.
2. No movement in the Y-axis.	a. Y-axis cable assembly defective.	a. Replace cable assembly.
	b. Foreign object lodged between track and pen carriage assembly.	b. Remove foreign object.
	c. Defective motor	c. Replace motor.
	d. Defective preamplifier module.	d. Repair or replace preamplifier module.
	e. Fuses blown on drive amp board.	e. Replace fuses.

SIGNAL MALFUNCTION

MALFUNCTION	CAUSE	REMEDY
1. Signal noise (ripple).	a. Ground straps not tight on input terminal.	a. Tighten Ground straps.
2. Noise and/or drift (3056 x1 range).	a. Lack of shielded banana plug on input cable or lack of proper twisted pair shielded cable. Air moving across the terminal posts can cause temperature differentials.	a. Make proper input connections. (See Section 2.5 in the Operator's Manual.)

MISC.

MALFUNCTION	CAUSE	REMEDY
Two outer pulleys (Fig. 6-9, item 18) for X-Axis cable rubbing on retaining ring, causing binding and wear.	Pulley occasionally moves upward on bearing until retaining ring is contacted.	Remove and re-install pulley assemblies with flanged end of bearing upward.

4.3 STAR DIAGRAM (FIGURE 4-1, 2, & 3)

In order to facilitate troubleshooting of the recorder circuitry, a Signal Tracing and Replacement (STAR) Diagram is included. A STAR diagram is a block diagram, expanded to include certain wiring diagram information, schematic diagram information and engineering maintenance information (signal levels, waveforms, test points, etc). Initially, this diagram can be used in conjunction with the Theory of Operation in Section II of this manual. As service personnel gain familiarity and experience with the equipment, the need to refer to the supporting descriptive text will gradually be eliminated.

The STAR diagram provides the essential information required to isolate a fault to a functional block. To use the STAR diagram, perform the Preliminary Set-up procedure below. Then, by applying the scope probe to each STARRED test point, proceed through the unit until the signal you obtain is different from the information on the diagram for that test point. Having done this, the block immediately prior to the "bad" test point indicates in which area the trouble lies. Going to that area on the board (and the schematic) components may be checked to find the failure. Be sure to verify that all power supply voltages are present and correct. The hexagonal symbols indicate adjustments.

Equipment Required

1. Wavetek, Model 142 Function Generator (or equivalent).

2. Gould Oscilloscope, Model OS1100 (or equivalent).

3. Digital Voltmeter: Data Prec. 3500 (Keithley 172A).

Procedure:

1. Before applying power, set the following front panel controls as instructed: The POWER, PEN DOWN, PAPER HOLD, STANDBY/OPERATE, and PREAMP-FILTER and % ZERO OFFSET OFF/ON * should all be in the released or full out position. Depress to release if necessary. The TIME BASE AXIS OFF and the PREAMP INPUT RANGE OFF should both be in the OFF or depressed position.

   Set both preamps input ranges to 2.5 mv/inch x 100 or 1.0 mv/cm x100.

2. Remove the writing table (platen) by removing the four edge screws (that secure the 2 trim strips) and the top and bottom center screws.

3. Disconnect J2 from both Drive Amp Boards. J2 is on the left rear corner of the boards.

4. Connect the function generator to the preamp input terminals. Set it for a 1Hz triangular wave output, 5V p-p for the X-axis preamp or 3V p-p for the Y-axis preamp.

5. Place the pen and the arm (X direction) approximately in the middle of their range of travel.

CAUTION: THE CARRIAGE MUST ALWAYS BE GRASPED NEAR THE UPPER END WHEN MOVING IT BY HAND.

6. TP1 on the Drive Amp Board (the front right corner) is "signal ground" and is a convenient point to attach the ground (LOW) probe of the scope and the DVM.

7. Depress the POWER button. Observe that the white power on indicator is lit.

8. Depress the STANDBY/OPERATE pushbutton.

9. Proceed to check the star test points with the oscilloscope.

10. Use the DVM to check TP-4 and TP-5 on the Drive Amp Board. Move the pen and arm over their travel ranges and check per the note on the star diagram for correct operation.

11. Make required repairs and re-check per star diagram. Re-calibrate any affected sections per Section III.

* Not on all models

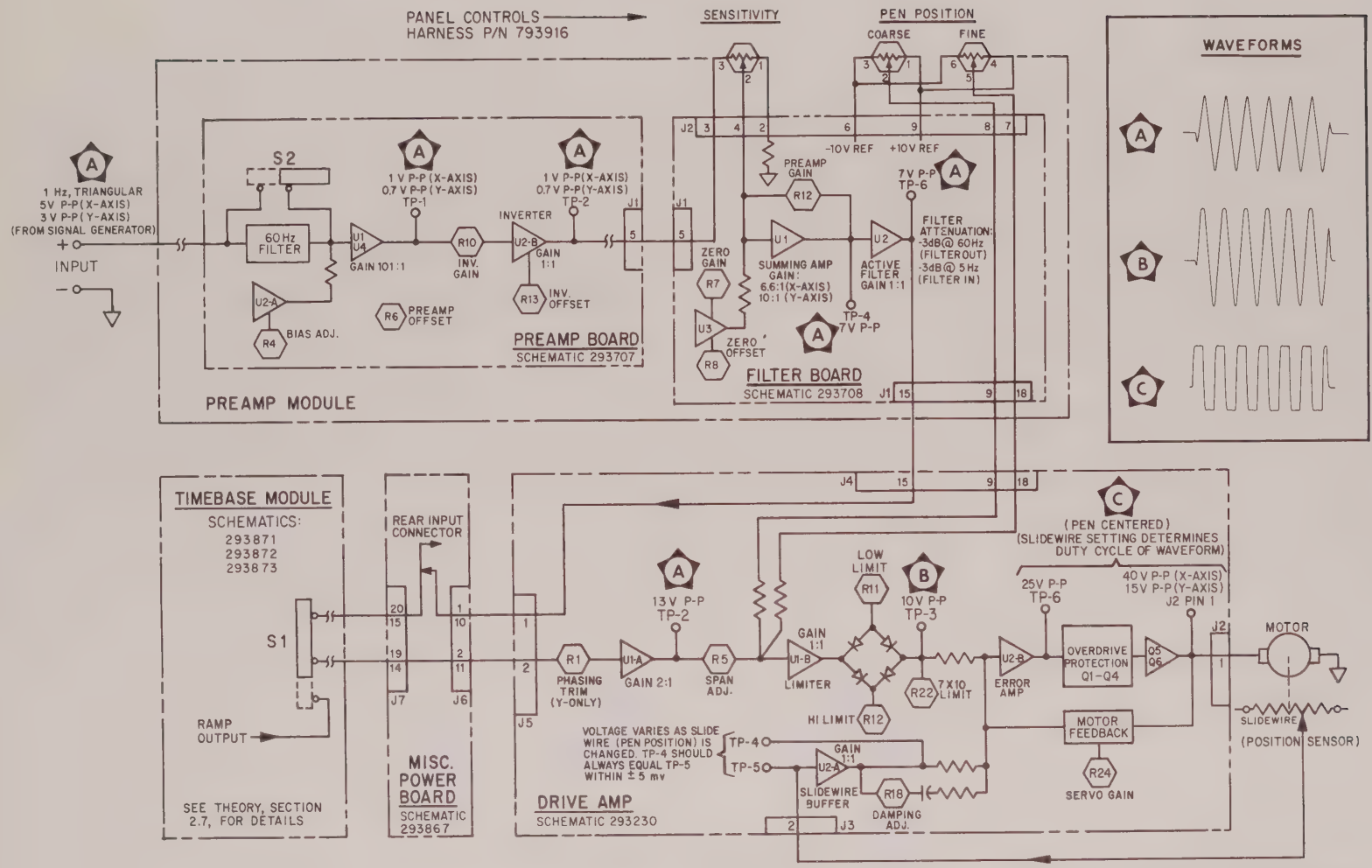


FIGURE 4-1 3054 X-Y RECORDER STAR DIAGRAM
(TYPICAL FOR BOTH CHANNELS, EXCEPT AS NOTED)

SYSTEM SCHEMATIC 294224

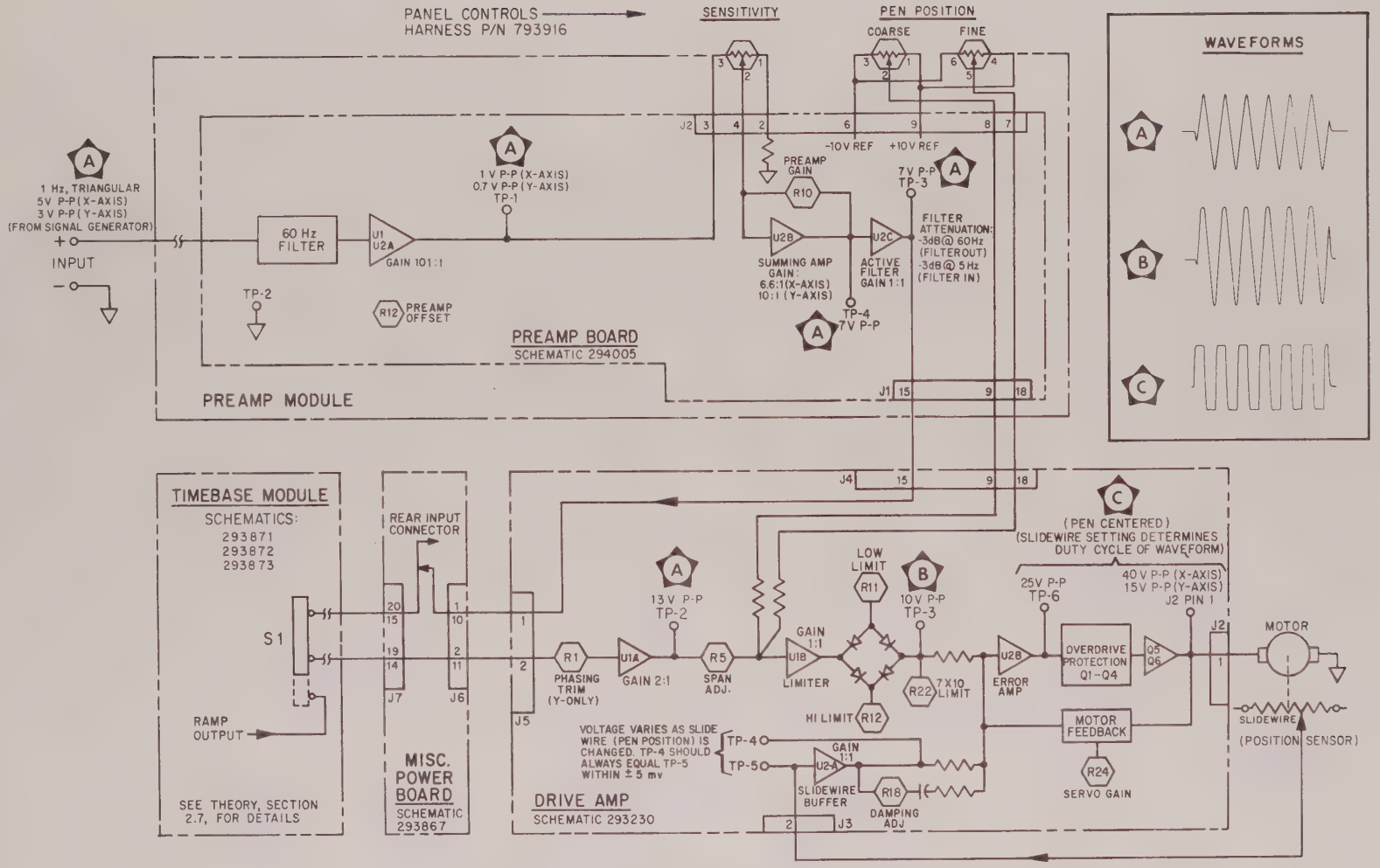


FIGURE 4-2 3052 X-Y RECORDER STAR DIAGRAM
(TYPICAL FOR BOTH CHANNELS, EXCEPT AS NOTED)

SYSTEM SCHEMATIC 294818

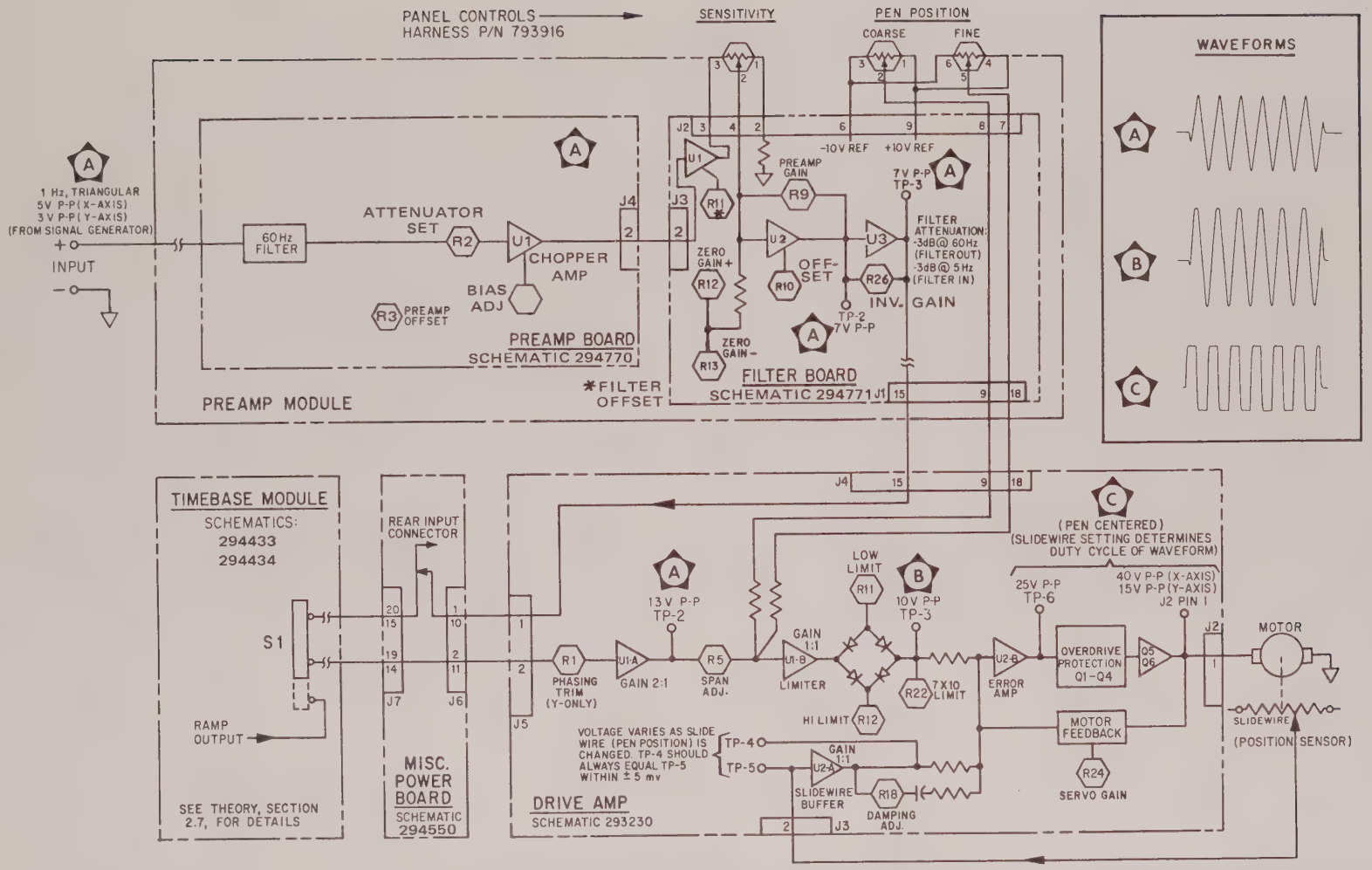


FIGURE 4-3 3056 X-Y RECORDER STAR DIAGRAM
(TYPICAL FOR BOTH CHANNELS, EXCEPT AS NOTED)

SYSTEM SCHEMATIC 294803

SECTION V

REPLACEMENT OF SUBASSEMBLIES

5.1 INTRODUCTION

The Gould 305X X-Y Recorder has been accurately calibrated and adjusted to give long, trouble-free service. For servicing beyond the scope of the instructions contained in this manual or the technical equipment available, contact the nearest Gould Service Representative.

The Parts Identification section of this manual lists all available parts and includes exploded views of major assemblies. Replacement of most sub-assemblies is straightforward and easily accomplished by referring to these exploded views, which also give part numbers and descriptions required when ordering replacement parts.

This section of the manual describes the removal and installation of parts and subassemblies which might require special instructions, adjustments, or procedures.

5.2 PRELIMINARY STEPS

Opening the front panel is described in Section 4.4 of the Operator's Manual. Replacement of the Preamp and Time Base Modules is described in Section 4.5 of the Operator's Manual.

WARNING: BEFORE ATTEMPTING TO SERVICE THE RECORDER OR OPEN THE FRONT PANEL, BE CERTAIN TO DISCONNECT OR TURN OFF THE POWER SOURCE AND DISCONNECT ALL INPUT CABLING.

5.3 WRITING TABLE ASSY (Figure 6-1, item 4)

The writing table is removed by removing the four edge screws (that secure the two panel trim strips, item 1 in Fig. 6-1) and the top and bottom center screws. Alignment of the table is explained in Section 3.8 of this manual, and would be required whenever the table has been loosened.

5.4 BOTTOM PLATE ASSY, 893372 (Fig. 6-14)

5.4.1 X-Axis Drive Bearing Assy (items 2, 4, 5, 11, 12, 13)

When assembling the above items, item 11 should be tightened last, positioning it for 0.002 - 0.006 inch end play of shaft. When assembling items 2, 3 (next paragraph), and 11, apply Loctitle, Cat. No. 635-41, to the shafts and setscrews.

5.4.2 X-Axis Drive Motor Pulley (item 3)

Position item 3 on the motor shaft so there is 0.062 inch clearance between the pulley and the motor housing.

5.4.3 X-Axis Drive Belt Tension

Adjust the timing belt (item 1) tension by pulling on the motor (item 7) near the motor mount (item 6) with a 4 ±0.5 pound pull as the motor mounting screws are tightened. (The motor should be pulled in a direction away from the bearing housing item 13.)

5.5 TRAVERSE RAIL, 293363 (Fig. 6-9 item 16)

The traverse rail is aligned by adjusting the support assemblies, items 11 and 20, so the center line of the rail and the front side of the resistive element, item 25, are parallel within 0.010 T.I.R.

5.6 TROLLEY ASSY 894084 (Figure 6-11, items 21-30)

5.6.1 Upper Bearing Pins (Fig. 6-11, item 22)

Press the item 22 pins into the trolley frame until 0.23 inch remains projecting. Then press the item 23 bearings on the pins flush against the frame. Seat the retaining rings against the inner race of the bearing with no end play.

5.6.2 Lower Bearing Adjustment (Fig 6-11, item 24)

The lower bearings, item 24 and their supports, item 25 are secured in position by the screw and washer listed as attaching parts under item 25. Adjust using setscrews item 30 so the lower bearings contact the bottom of the traverse rail (Fig. 6-9, item 16). Use Grade H Loctite on set-screws item 30.

5.7 Y-AXIS ARM ASSY, 894085 (Fig. 6-13)

5.7.1 Shuttle Tightness

Adjust side play in the shuttle Assy, items 8-18, using the item 8 setscrews and the access holes. Use Grade E Loctite on the setscrews. Set for minimum friction and minimum looseness. Slide shuttle back and forth several times to verify proper operation.

5.7.2 Shuttle Path Lubrication

Apply this film of synthetic grease (Nye Rheolube 363, W.F. Nye Inc., New Bedford, Mass, or equivalent) into the "VEE" - ways for the entire distance of shuttle travel. Do this whenever replacing the shuttle or the lower arm assy, or as required by conditions.

5.7.3 Pen Tip Pressure

It is recommened that the pen tip pressure be checked while the cover assy (Fig. 6-12) is off of the arm assy (Fig. 6-13), since adjusting the pressure requires this condition. Measure the force required to just lift the pen tip off the chart paper. It should be 13 to 15 grams. To adjust, move the small arm, item 18, which will vary the spring tension. This requires loosening two screws.

5.7.4 Pen Cartridge Holder (item 15)

When replacing this item make the distance between the holder body and the "arm" (plate on the other end of the shaft) equal to 0.851 inch.

5.8 Y-AXIS COVER ASSY, 793601 (Fig. 6-12)

5.8.1 Wiring to Resistive Element (item 14)

Solder wires into eyelets. Do not allow excessive build-up of solder around joints. Lay wires down on item 14 as shown and keep wires away from screw hole to prevent pinching. No solder or bare wire is permitted which could short the rivets on item 14 to item 15 or 16.

5.8.2 Wiring to Element Shield (item 15)

The white wire is soldered into the groove in item 15 by first stripping and tinning ¼", then folding the bare end in half and soldering it in place. The insulation should overlap the edge of item 15. The build-up of solder over the surface of copper must be 0.010 inch maximum. Keep this wire away from screw hole to prevent pinching.

5.8.3 Alignment of Pen Lift Shaft Assy (item 12)

With the axis of the screw (attaching part under item 9 that holds item 9 to the shaft) perpendicular to the top surface of item 16, the gears on the shaft must be centered in the racks (items 11 and 13). Note that whenever any of these parts associated with the pen lifting operation are replaced or disturbed it will be necessary to re-adjust per Section 3.6 in the Calibration Section.

5.8.4 Pen Lift Solenoid (item 3)

This solenoid is mounted to slotted holes for further adjustment, if required. Note that a small hole has been provided in the back (housing element, item 22 on Fig 6-9) for convenient access to the lower solenoid attaching screw. Move the trolley until the hole and screw line up.

5.9 TROLLEY & ARM ASSY, 893818 (Fig. 6-11)

5.9.1 Y-Axis Arm Alignment

Adjust setscrews items 29 to align item 31. It must be perpendicular to the traverse rail (Fig. 6-9, item 16) within 0.005 T.I.R. Use Grade H Loctite on setscrews item 29.

5.9.2 Drive Capstan Adjustment

Position drive capstan item 18 so that center of groove in pulley is 0.268 inch from bottom (inside) of lower arm.

5.10 RESTRINGING X-AXIS

a. Cut 57 inches of cable, item 55 on Figure 6-9. Try to avoid getting twists in the cable when stringing.

b. Refer to Figures 6-11 and 5-1. Remove wire take-up, item 26 (cable tension screw) from the trolley assembly.

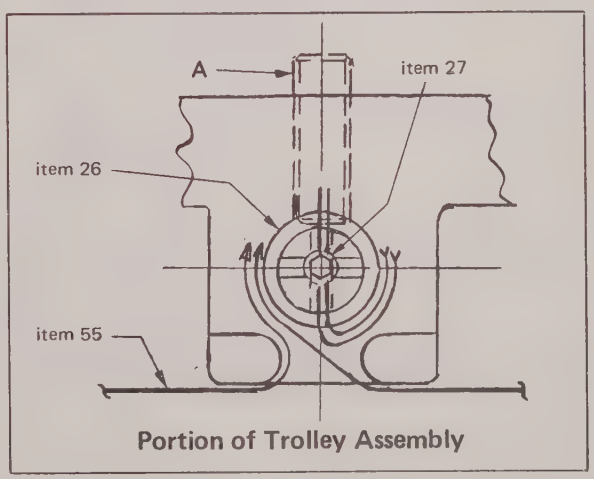


FIGURE 5-1 CABLE TENSION SCREW

c. Insert both ends of the cable through the hole, after loosening the setscrew item 27. The ends should protrude through item 26 about 1/8 to 1/4 inch as shown in Figure 5-1. Tighten item 27.

d. Replace item 26 into the trolley assembly with the cable dropping straight down. Loosely insert the setscrew (A) to retain item 26, but do not tighten.

e. Loop the cable around the right-hand pulley (see item 18, Fig. 6-9), then make 5 turns around the capstan (see Figures 6-9 and 5-2), and then loop around the left hand pulley. NOTE: The Y-Axis trolley and arm assy (Fig. 6-9, item 13) must be positioned at the mid-point of its travel span when the 5 turns of cable are centered on the capstan as shown.

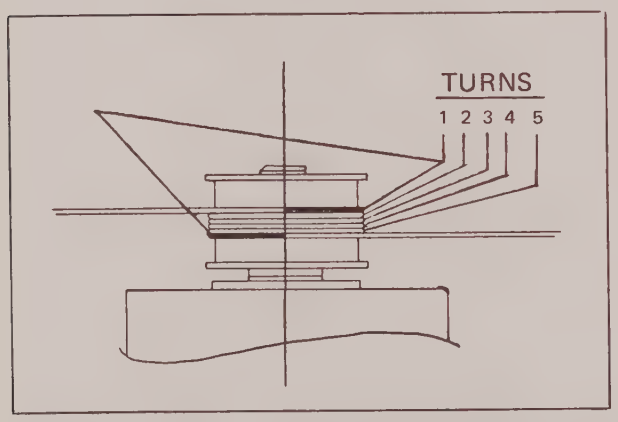


FIGURE 5-2 CAPSTAN STRINGING

f. Turn the cable tension screw (item 26, Fig. 6-11) clockwise to tighten the cable. If new cable, apply 48 inch-ounces to item 26 and lock in position with set screw (A in Fig. 5-1). If restringing used cable, only 40 inch-ounces should be used. New cable stretches slightly.

5.11 RESTRINGING Y-AXIS (See Fig. 6-11 & 6-13)

a. Cut 34 inches of cable, item 15 on Fig. 6-11. Try to avoid getting twists in the cable when stringing.

b. Form a small loop at one end of the cable using the sleeve, item 14 on Fig. 6-11 as shown:

c. Place the loop under the washer shown as item 12 on Fig. 6-13. (This washer must already be secured in place on the shuttle by its screw.)

d. Tighten the loop by sliding the sleeve, then crimp the sleeve to make the loop permanent.

e. String the cable "up" to and around the drive capstan, item 18 on Fig. 6-11, then "downward" under shaft assy item 16 Fig. 6-13 and around the pulley assy item 7.

f. Bring the cable back up to the shuttle, go about ¼ turn around (under) another washer/screw (similar to that mentioned in step c) and run the cable through the hole in the Y-Axis Wire Take-Up, item 11 on Fig. 6-13. The wire take-up may be removed by loosening setscrew item 9, Fig. 6-13 to facilitate this step.

g. With the wire take-up back in place, tie a firm double knot in the cable close to the wire tape-up. Cut off excess.

h. Tighten the wire take-up screw to 8 inch-ounces and lock in position with setscrew, item 9 on Fig. 6-13.

5.12 PULLEY ASSY (Figure 6-9, items 17 & 18)

When assembling the above items, apply Loctite Cat. No. 60141 to the mating surfaces, then press item 17 into item 18 as shown.

CAUTION: DO NOT ALLOW ANY LOCTITE TO GET ON MOVING PARTS OF ITEM 17.

SECTION VI

PARTS IDENTIFICATION

This instrument has been accurately calibrated and adjusted before shipment from the factory and should give long, trouble-free service. For servicing beyond the scope of the instructions contained in this manual or the technical equipment available, contact your nearest Gould Service Engineer listed on the warranty card shipped with the recorder.

The following parts lists, exploded views, and drawings are designed to assist in servicing and repairing the recorder.

Schematic drawings are in the appendix (rear section) of this Manual, in numeric order.

To assure prompt and satisfactory delivery of replacement parts, include the following with the purchase order:

1. Name, model number and serial number of the instrument.
2. Description of the part as listed in the parts list.
3. Gould part number.

NOTES

1. **Do not use the SYMBOL NUMBER from the parts list for identifying desired parts on the order.**
2. **† Obelisk indicates items not procurable as an assembly.**
3. (A-P) indicates that the following parts, up to ——————*——————, are Attaching Parts; i.e. unillustrated hardware required to attach the preceding item to the assembly.

RECORDER ASSY, X-Y PLOTTER
PART NUMBER 15-3307-XX
FIGURE 6-1

Basic 3054 Recorder (See Note)	Model Number
English Unit	15-3307-00
English Unit with Timebase	15-3307-10
Metric Unit	15-3307-06
Metric Unit with Timebase	15-3307-16

ITEM NUMBER	PART NUMBER	DESCRIPTION	USED ON (▲)
1	794002	Panel, Trim (A-P)	-00, 10, 06, 16
	31-119920-2608	Screw, Machine ——————*——————	-00, 10, 06, 16
2	694281	Bracket, Shipping	-00, 10, 06, 16
3	893607	Cover Assy, X-Axis (A-P)	-00, 10, 06, 16
	31-119920-4006	Screw, Machine ——————*——————	
3A	232736-32	Tape, Mylar	
4	894135	Table Assy, Writing (See Fig. 6-2) (A-P)	-00, 10, 06, 16
	31-119920-4008	Screw, Machine ——————*——————	
5	894176-1	Time Base Assy (See Fig. 6-3)	-10 (Type I®)
5	894176-2	Time Base Assy (See Fig. 6-3)	-16 (Type I)
5	894176-3	Time Base Assy (See Fig. 6-3)	-00, 06
5	894451-1	Time Base Assy (See Fig. 6-6)	-10 (Type II®)
5	894451-2	Time Base Assy (See Fig. 6-6)	-16 (Type II)
6	116198-11	Fuse 1.5 A 3AG (Slo-Blo)	-00, 10, 06, 16
7	893371	Chassis Assy (See Fig. 6-9)	-00, 10, 06, 16
8	893872	Board Assy, Time Base Logic (See Fig. 6-16)	-10, 16 (Type I only)
9	893900-1	Pre-Amp Assy, Y-Axis (English) (See Fig. 6-17)	-00, 10
9	893900-2 (See Note)	Pre-Amp Assy, Y-Axis (Metric) (See Fig. 6-17)	-06, 16
10	893226-1 (See Note)	Pre-Amp Assy, X-Axis (English) (See Fig. 6-18)	-00, 10
10	893226-2 (See Note)	Pre-Amp Assy, X-Axis (Metric) (See Fig. 6-18)	-06, 16

®Type 1: Analog Timebase - shipped thru Oct., 1981; Type II: Digital Timebase - shipped after Oct., 1981.

NOTE: The 3052 and 3056 Recorders are the same as the 3054 in Figure 6-1 except for the item 9 and 10 preamps. The 3052 Y Axis preamp, item 9, is P/N 894924 (See Figure 6-22) and the X Axis preamp, item 10, for the 3052 is P/N 894923 (See Figure 6-23). The 3056 Y Axis preamp, item 9, is P/N 894847-2 (Metric), -1 (English) (See Figure 6-26) and the X Axis preamp, item 10, is P/N 894846-1 (English), -2 (Metric) (See Figure 6-27).

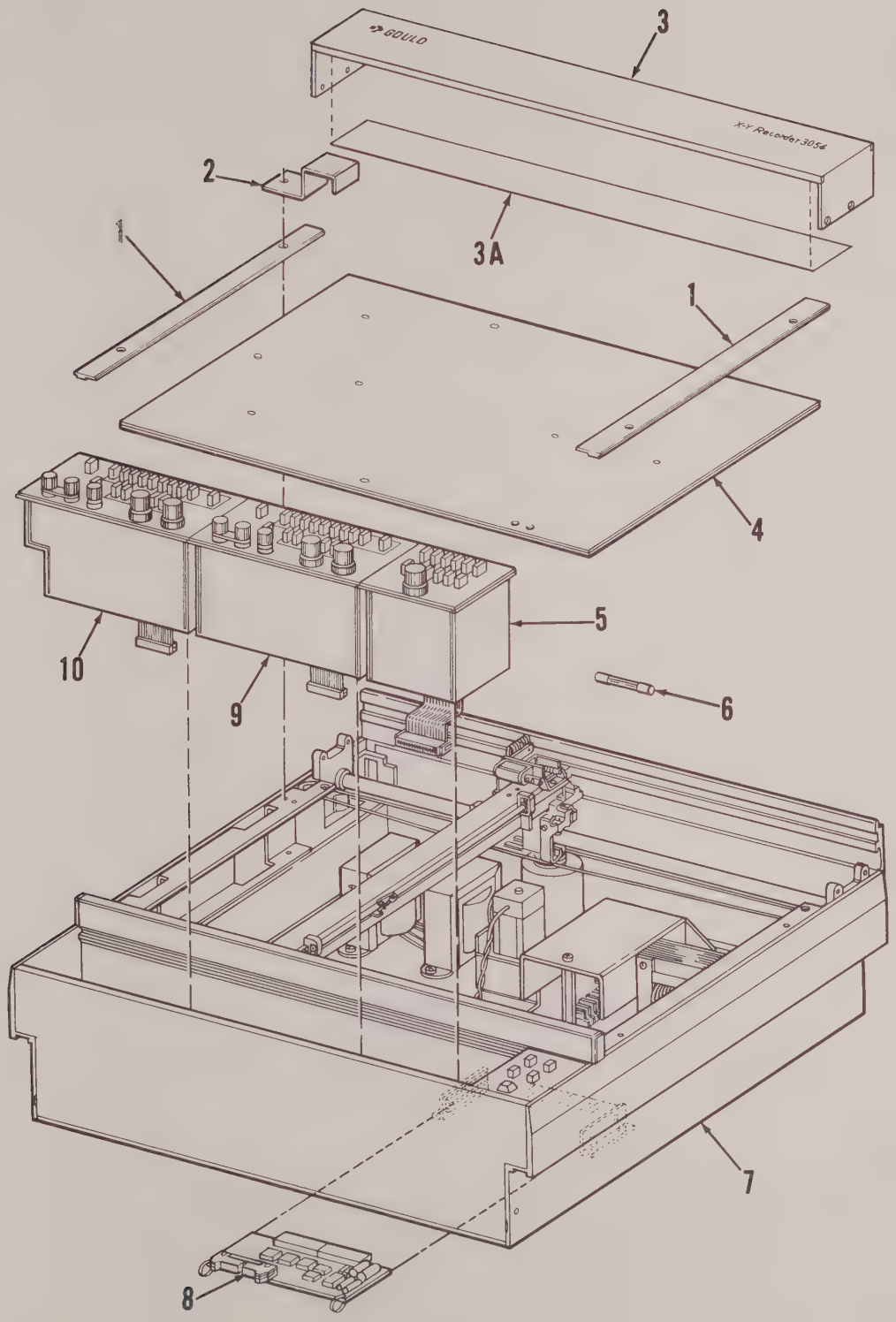


FIGURE 6-1 RECORDER ASSY, X-Y PLOTTER

TABLE ASSY, WRITING
PART NUMBER 894135
FIGURE 6-2

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER
1	793598	Board Assy, Table (See Note 1.)	
	694116	Cable Assy, High Voltage	
2	9-281501-3	Connector	
3	281506-2	Contact	
4	270903-11	Clamp, Adhesive	
	694117	Cable Assy	
5	265015	Terminal Quick Disconnect	
6	5-130340-300	Resistor	
7	234339	Lamp	
	794136	Lamp Bracket Assy (A-P)	
	1-216741-411	Lockwasher, Spring	
	31-119998-40	Nut, Hex	
		-----*-----	
8	394101	Bracket, Lamp	
9	894111	Board Assy (A-P)	
	13-262716-4004	Screw, Self-Tapping	
		-----*-----	
10	294110	Contact Elect (A-P)	
	31-119914-4006	Screw, Mach	
	1-118195-304	Washer, Plain	
	31-119998-40	Nut, Hex	
	1-216741-411	Lockwasher	
		-----*-----	
11	894010	Plate Assy, Cover (A-P)	
	1-216741-411	Lockwasher, Spring	
	31-119998-40	Nut, Hex	
		-----*-----	
12	248476-2	Spacer	
13	694175	Fibre Optic Assy (See Note 1.) (A-P)	
	13-262716-4004	Screw, Self Tapping	
		-----*-----	
14	294713	Cover	

NOTE 1: Field replacement not recommended, since the optical Fibres are cemented into item 1 and replacement would be difficult. It is preferable to replace the entire Writing Table Assy, 894135.

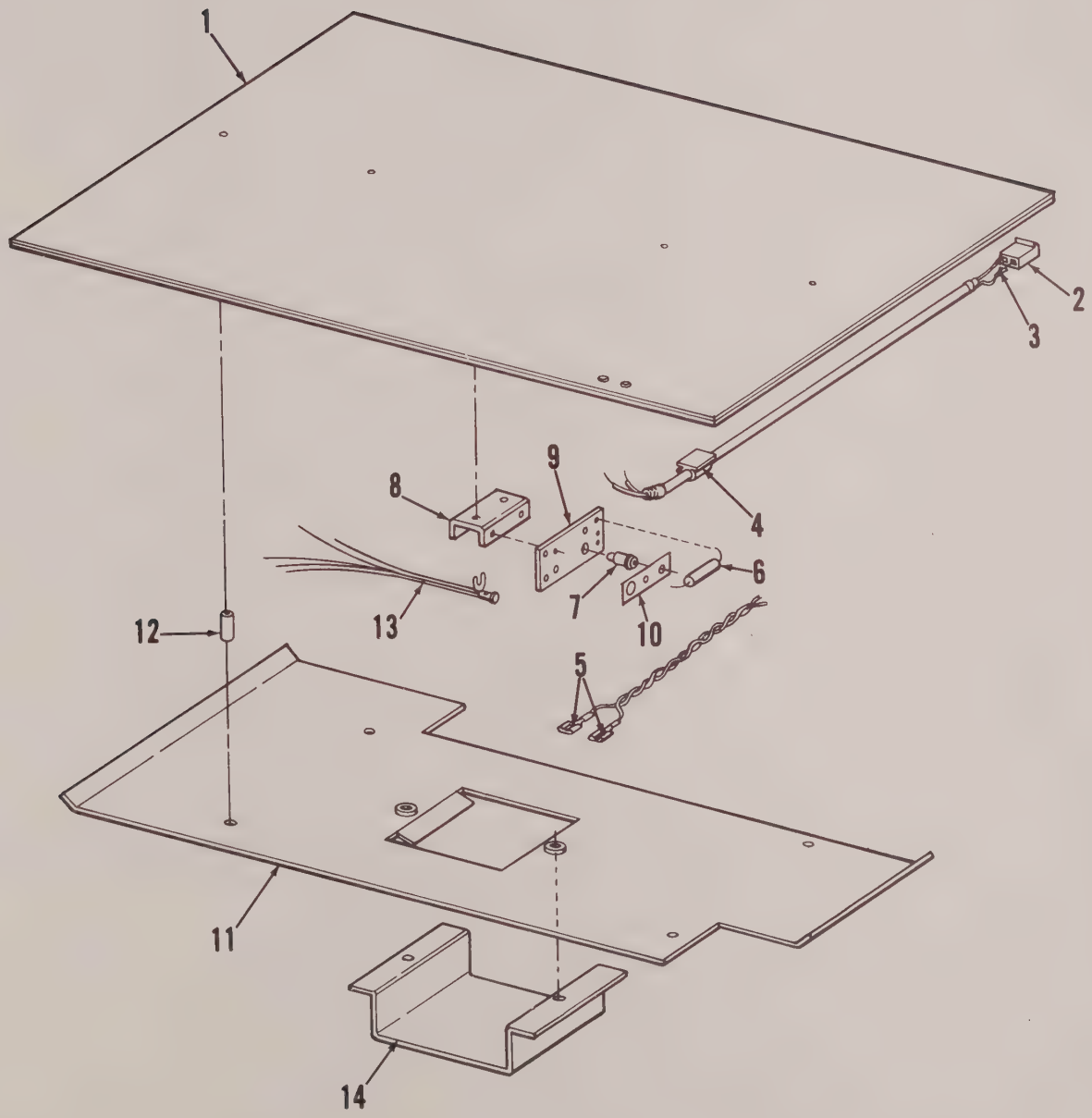


FIGURE 6-2 TABLE ASSY, WRITING 894135

TIME BASE ASSY, ANALOG*
PART NUMBER 894176-X
FIGURE 6-3

ITEM NUMBER	PART NUMBER	DESCRIPTION	USED ON
	894176-1	Time Base Assy (English)	A
	894176-2	Time Base Assy (Metric)	B
	894176-3	Time Base Assy (Blank Panel)	C
1	285651-3	Knob	A, B
2	694245	Knob Assy, Locking	A, B
3	1-293279-1	Nut	A, B
4	794242-1	Front Panel, English	A
	794242-2	Front Panel, Metric	B
	393548	Front Panel, Blank (A-P)	C
	31-119918-4006	Screw	A, B. C
	1-103838-12	Nut	A, B, C
		-----*-----	
	694127	Cable Assy, End Scan	A, B
5	293271-1	Resistor, Variable 25K	
6	287490	Contact	
7	287491-4	Connector	
8	287489	Key	
9	893871	Board Assy, Integrator (See Fig. 6-4) (A-P)	A, B
	13-262716-2604	Screw	A, B
		-----*-----	
10	893873	Board Assy, Control (See Fig. 6-5) (A-P)	A, B
	13-262716-2604	Screw	A, B
		-----*-----	
11	794112	Cable Assy, Flat	A, B
	2-292531-26	Connector, Elec. (Quan. 2)	A, B, C
	291311-1	Connector, DIP (Quan. 1)	A, B, C
	282356-3	Label, Up	A, B, C
12	793684	Shield Assy, Silkscreen	A, B, C

*NOTE: Used only on units shipped thru October, 1981 (see page 6.2)

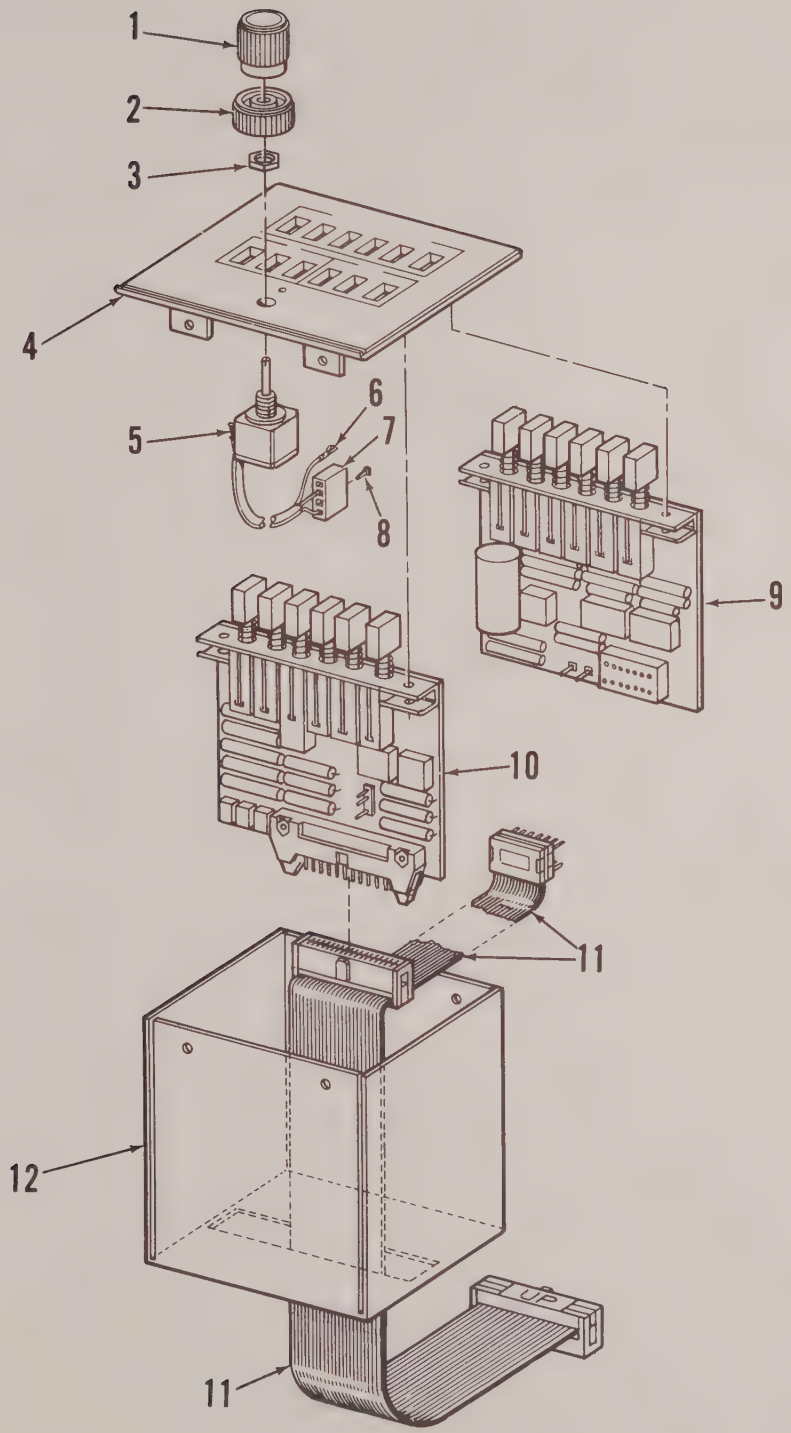


FIGURE 6-3 TIME BASE ASSY 894176-X

INTEGRATOR BOARD ASSY*
PART NUMBER 893871
FIGURE 6-4

SYMBOL NUMBER	PART NUMBER	DESCRIPTION
C1, C2	10-263695-106	Capacitor 10μf
C3	10-281282-106	Capacitor 10μf
CR1, CR2	269256-7	Diode IN4007
J1	285593-14	Socket, Dip 14 Pin
Jumper	267235	Jumper Circuit
R1	25-265969-10003	Resistor 1 Meg
R2	25-265969-50002	Resistor 500K
R3	25-265969-10002	Resistor 100K
R4	25-265969-50001	Resistor, 50K
R5	25-265969-10001	Resistor, 10K
R6	25-265969-50000	Resistor, 5K
R7	25-265969-10003	Resistor, 1 Meg
R10	5-241111-221	Resistor, 220 ohm
R11	293941-103	Resistor, Variable 10K
S1	293950	Switch, Pushbutton
TP1, TP2	265763-3	Contact, Elec.
U1	294181-2	I.C. AD542
U2, U3	293735-1	Relay 191TE1A1-5S

*NOTE: Used only on Analog Time Base units (shipped thru October, 1981).

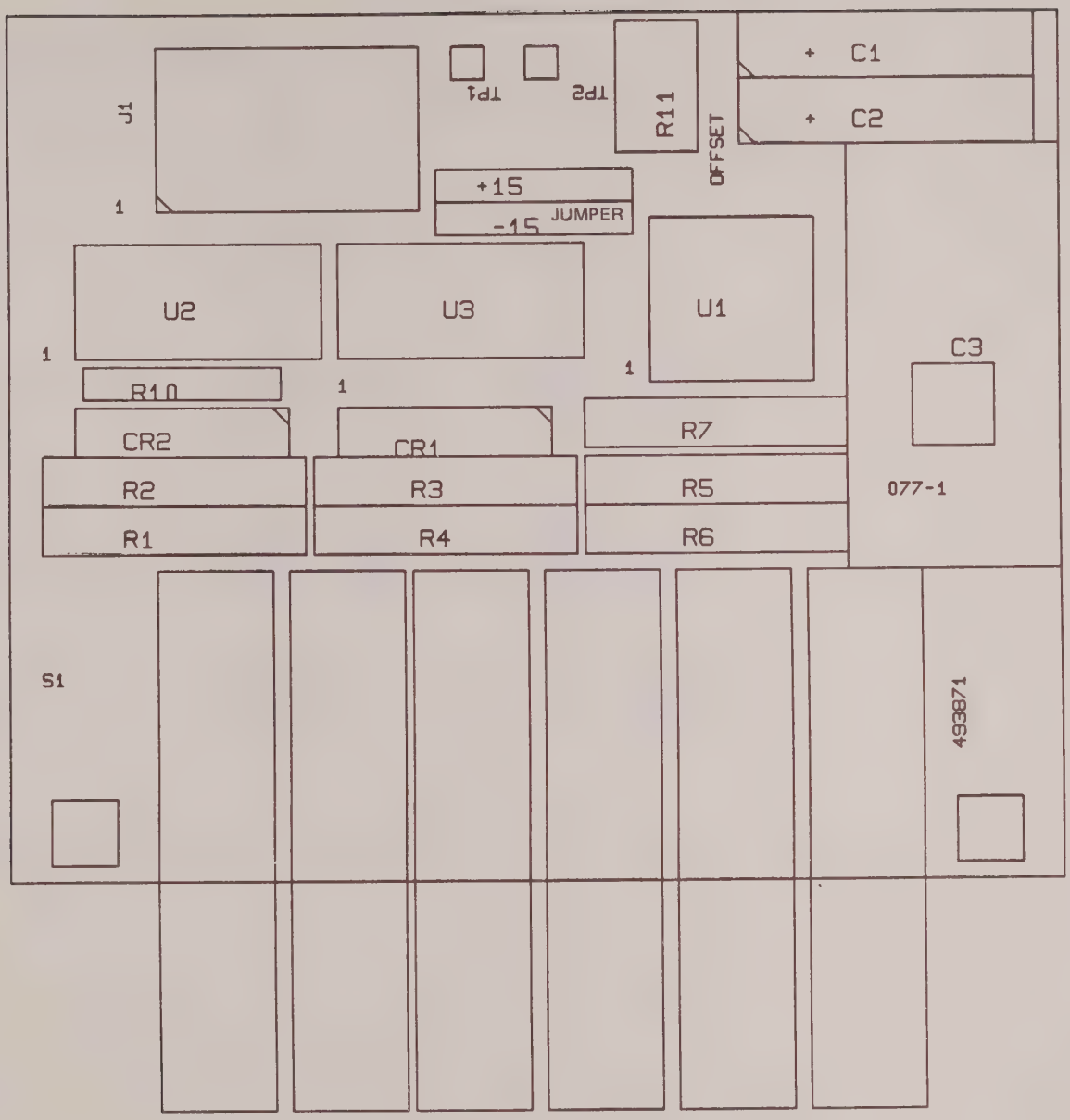


FIGURE 6-4 INTEGRATOR BOARD ASSY 893871

CONTROL BOARD ASSY*
PART NUMBER 893873
FIGURE 6-5

SYMBOL NUMBER	PART NUMBER	DESCRIPTION
C1	262585-475	Capacitor 4.7μf
C2	10-125904-103	Capacitor .01μf
J1	1-292529-26	Connector
J2	1-287495-4	Connector
R1, R2	293941-201	Resistor, Variable 200 ohm
R3, R4	1-265969-300R0	Resistor, 300 ohm
R5	25-265969-10R00	Resistor, 10 ohm
R6	25-265969-15R00	Resistor, 15 ohm
R8	1-265969-10001	Resistor, 10K
R9	1-265969-50000	Resistor, 5K
R10	293941-103	Resistor, Variable 10K
R12, R13	25-265969-50001	Resistor, 50K
R14	25-265969-10002	Resistor, 100K
S1	293951	Switch, Pushbutton
TP1	265763-3	Contact, Elec.
U1	289760	I.C. Ref. MC1403
U2	280863-3	OP Amp LM741CN

*NOTE: Used only on Analog Time Base units (shipped thru October, 1981).

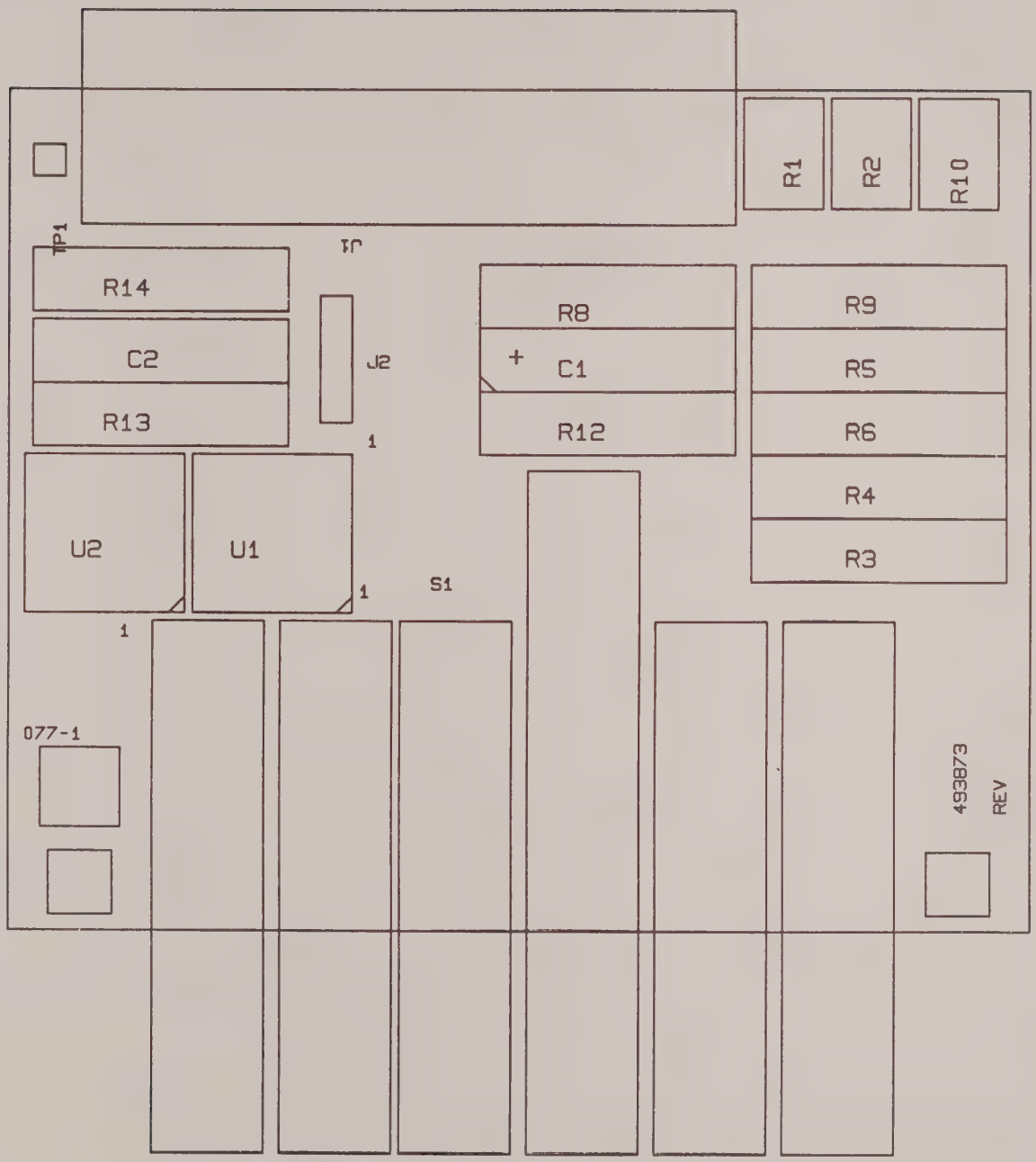


FIGURE 6-5 CONTROL BOARD ASSY 893873

TIME BASE ASSY, DIGITAL
PART NUMBER 894451-X
FIGURE 6-6

ITEM NUMBER	PART NUMBER	DESCRIPTION	USED ON
	894451-1	Time Base Assy (English)	A
	894451-2	Time Base Assy (Metric)	B
	894451-3	Time Base Assy (Blank Panel)	C
1	285651-3	Knob	A, B
2	694245	Knob Assy, Locking	A, B
3	1-293279-1	Nut	A, B
4	795261-1	Front Panel, English	A
	795261-2	Front Panel, Metric	B
	393548	Front Panel, Blank	C
		(A-P)	
	31-119918-4006	Screw	A, B, C
	1-103838-12	Nut	A, B, C
		-----*-----	
	694127	Cable Assy, End Scan	A, B
5	293271-1	Resistor, Variable 25K	
6	287490	Contact	
7	287491-4	Connector	
8	287489	Key	
9	894433**	Board Assy, Clock (See Fig. 6-7)	A, B
		(A-P)	
	13-262716-2604	Screw	A, B
		-----*-----	
10	894434**	Board Assy, D/A (See Fig. 6-8)	A, B
		(A-P)	
	13-262716-2604	Screw	A, B
		-----*-----	
11	794841	Cable Assy, Flat	A, B
	2-292531-26	Connector, Elec. (Quan. 2)	A, B, C
	291311-1	Connector, DIP (Quan. 1)	A, B, C
	282356-3	Label, Up	A, B, C
12	794928	Shield Assy, Silkscreen	A, B, C
13	289396	LED	
14	794926	Cable Assy	

**No suffix indicates English version, -1 indicates Metric.

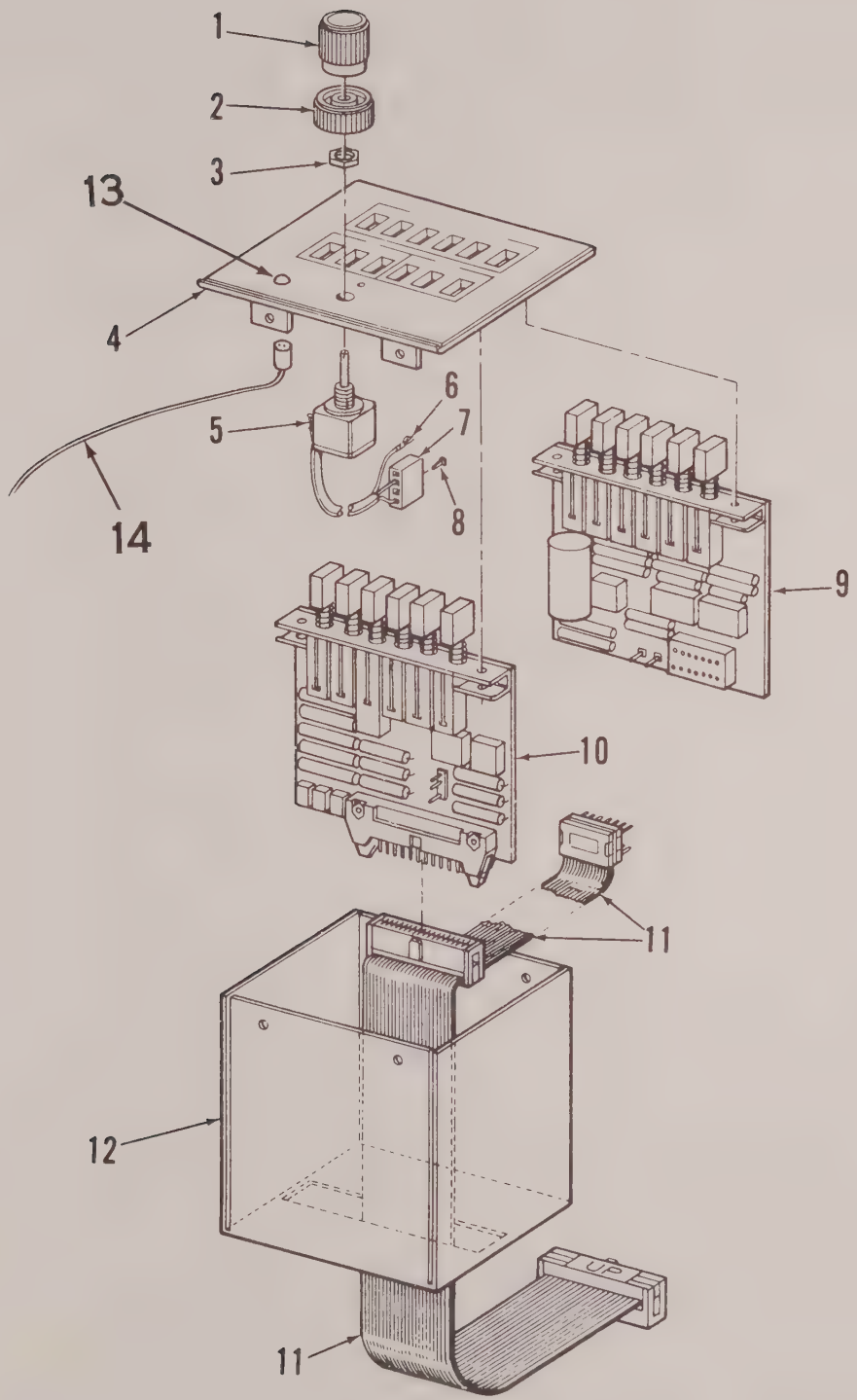


FIGURE 6-6 TIME BASE ASSY 894451-X

CLOCK BOARD ASSEMBLY
PART NUMBER 894433
FIGURE 6-7

SYMBOL NUMBER	PART NUMBER	DESCRIPTION	
C1	20-285066-1	Capacitor, 1 μf	
C2	10-263735-103	Capacitor, .01 μf	
C3	285763-503	Capacitor, .05 μf	
CR1, CR2	269256-7	Diode IN4007	
J1	285593-14	Connector 14 Pin	
J2	1-287495-5	Connector 5 Pin	
Q1	286143	Transistor, 2N3906	
R1 thru R3	5-241111-203	Resistor, 20 K	
R4	5-241111-102	Resistor, 1K	
R5	5-241111-203	Resistor, 20K	
R6	293941-202	Reisistor, Variable 2K	
R7	1-265969-82000	Resistor, 8.2K	
R8	5-241111-470	Resistor, 47 ohms	
R9	1-265969-25002	Resistor, 250K	
R10	1-265969-68100	Resistor, 6.81K	
R11	1-265969-10002	Resistor, 100K	
R12, R13	5-241111-511	Resistor, 510 ohms	
R14	5-241111-203	Resistor, 20K	
R15	5-241111-103	Resistor, 10K	
S1	293950	Switch, Pushbutton (A-P)	
	31-119918-2604	Screw	
	230822-26	Nut, Hex, Self-Locking	
		----*----	
TP3, TP4	265763-3	Contact, Elect.	
U1	293086	IC, LM331	
U2	284684	IC, MC14011B CMOS	STATIC SENSITIVE COMPONENTS
U3	290305-518	IC, MC14518B CMOS	
U4	294311	IC, MM74C74N CMOS	

D/A BOARD ASSEMBLY
PART NUMBER 894434
FIGURE 6-8

SYMBOL NUMBER	PART NUMBER	DESCRIPTION	
BR1	282295-5	Rectifier, Bridge, VE28	
C1, C2	269241	Capacitor, 47 μf	
C3	288755-103	Capacitor, .01 μf	
C4	288755-104	Capacitor, .1 μf	
C5	281344-103	Capacitor, .01 μf	
C6	288755-103	Capacitor, .01 μf	
J1	1-292529-20	Connector 20 Pin (A-P)	
	31-119918-2606	Screw	
	31-119998-26	Nut	
		—————*—————	
J2	1-287495-4	Connector 4 Pin	
J3	1-287495-7	Connector 7 pin	
R1	R1-288308-10001	Resistor, 10K	
R2	R1-288308-20001	Resistor, 20K	
R3, R4	293941-103	Resistor, Variable 10K	
R5	25-265969-10001	Resistor, 10K	
R6	R1-284694-10001	Resistor, 10K	
R7	R1-284694-40000	Resistor, 4K	
R8	25-265969-50000	Resistor, 5K	
R9	5-241111-202	Resistor, 2K	
R10	5-241111-104	Resistor, 100K	
S1	294789	Switch, Pushbutton (A-P)	
	31-119918-2604	Screw	
	230822-26	Nut, Hex, Self-Locking	
		—————*—————	
TP1, TP2	265763-3	Contact, Elect.	
TP5	265763-3	Contact, Elect.	
U1	294197	IC DAC AD7541JN CMOS	STATIC SENSITIVE COMPONENTS
U1-SKT	292709-18	Socket, I.C. 18 Pin	
U2	284438	IC Counter CD4040B CMOS	
U3	291305	Comparator LM311	
U4	291062-2	Op Amp TL083	
U5	294795	Regulator MC79L15	
U6	289760	IC REF MC 1403	
U7	294794	Regulator MC78L15	

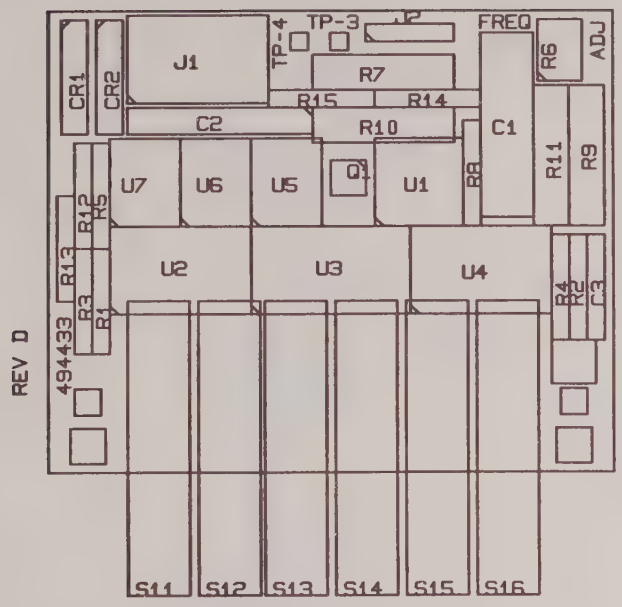


FIGURE 6-7 CLOCK BOARD ASSY. 894433

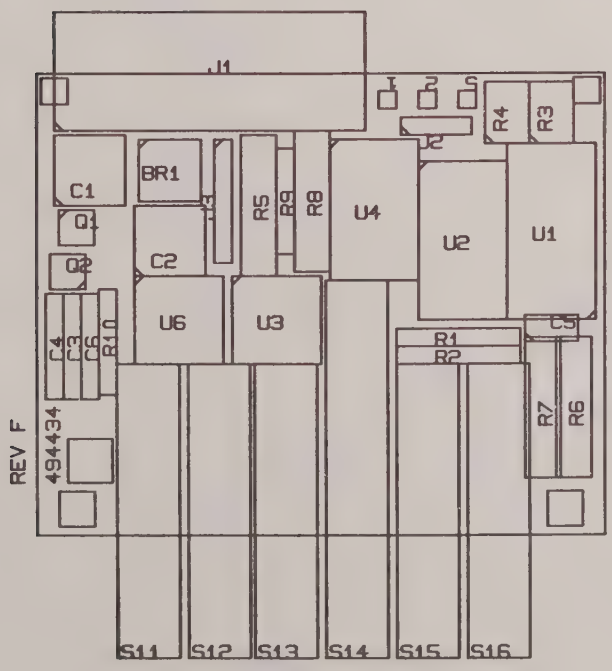


FIGURE 6-8 D/A BOARD ASSY. 894434

CHASSIS ASSY
PART NUMBER 893371
FIGURE 6-9

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER
	893230-X	Board Assy, Drive Amplifier (A-P)	
	13-262716-6204	Screw, Self-Tapping	
		-----*-----	
1	293899	Clip, P.C. Support (A-P)	
	31-119914-2608	Screw	
	243104-5	Washer, Plastic	
	1-216741-401	Lockwasher	
	31-119998-26	Nut, Hex	
		-----*-----	
2	393713	Bracket, Heat Sink (A-P)	
3	1-107283-102	Rivet	
	292900	Kit, Insulation	
	31-119914-4007	Screw	
	1-120053-201	Lockwasher	
	31-119998-40	Nut, Hex	
	230769-9	Washer, Fiber Shoulder	
	293848-3	Insulator, Heat Sink	
		-----*-----	
4	----	Board Sub-Assy, Drive Amp. (See Fig. 6-10)	
	794094	Harness Assy	
5	287489	Key	
6	287491-6	Connector	
7	287490	Contact	
8	281504	Key	
9	0-281501-15	Connector	
10	281506-2	Contact	
11	693906	Support Assy, L.H.	
	240161-724	Pin (Part of Item 11) (A-P)	
	31-119914-8210	Screw, Mach	
	1-216741-425	Lockwasher, Spring	
		-----*-----	
12	244300-10	'O' - Ring	
13	893818	Trolley & Arm Assy (See Fig. 6-11)	
	794047	Wiper & Mount Assy (A-P)	
	31-119917-2614	Screw Mach	
	1-216741-401	Lockwasher	
	2-118195-101	Washer, Flat	
		-----*-----	
14	393481	Holder Wiper	

CHASSIS ASSY
PART NUMBER 893371
FIGURE 6-9 (Continued)

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER
15	293270	Wiper Assy	
		(A-P)	
	31-119914-2602	Screw	
		------*------	
16	293363	Rail Traverse	
	693585	Pulley Assy ←	
		(A-P)	
	9-227070-6	Ring, Retaining ←	
		------*------	
17	293953-1	Bearing Ball	
18	293361	Pulley	
19	269944	Spacer ←	
20	693905	Support Assy, R.H.	
	240161-724	Pin (Part of Item 20)	
		(A-P)	
	31-119914-8210	Screw Mach	
	1-216741-425	Lockwasher, Spring	
	123671-6204	Screw, Set	
		------*------	
21	270903-16	Clip, Adhesive	
	793600	Element & Housing Assy	
		(A-P)	
	31-119914-6205	Screw Mach	
	1-216741-420	Lockwasher	
		------*------	
22	793502	Housing Element	
23	793498	Shield Element	
24	151815-5	Insulating Tape	
25	392566	Element, Resistive	
		(A-P)	
	31-119918-2603	Screw, Mach	
		------*------	
26	294053	Clamp	
		(A-P)	
	31-119918-2604	Screw Mach	
		------*------	
	794093	Cable Assy, Feedback X-Axis	
27	287489	Key	
28	287491-5	Connector	
29	287490	Contact	
30	394180	Cover	
		(A-P)	
	1-216741-420	Lockwasher	
	31-119918-6204	Screw, Mach	
		------*------	

NOTE: One each of these three items is included with each Support Ass'y (item 11 and item 20).

CHASSIS ASSY
PART NUMBER 893371
FIGURE 6-9 (Continued)

ITEM NUMBER	PART NUMBER	DESCRIPTION
31	393910-1	Bracket, Corner L.H. (A-P)
	243898-82	Nut Assy, Lockwasher
		-----*-----
	694095	Cable Assy, A.C. Dist
32	265840-2	Lug
33	2-291410-1	Contact
34	793503	Panel Assy, Rear (A-P)
	31-119918-8206	Screw, Mach
		-----*-----
35	393373	Support, Table (A-P)
	31-119918-8206	Screw, Mach
	1-216741-425	Lockwasher, Spring
	1-118195-307	Washer, Plain
		-----*-----
36	393910-2	Bracket, Corner R.H. (A-P)
	243898-82	Nut Assy, Lockwasher
		-----*-----
37	893603	Panel Assy, Side R.H. (A-P)
	31-119918-8206	Screw, Mach
		-----*-----
38	243104-8	Washer, Nylon
39	893372	Plate Assy, Bottom (See Fig. 6-14)
40	393599-2	Cap, End
41	894202	Panel Assy, SW (See Fig. 6-15) (A-P)
	232997-23	Strap, Retaining Cable (to attach cables to elastic cord)
		-----*-----
42	293914	Bar, Locking (A-P) (for item 42)
	31-119918-4004	Screw, Mach
	1-216741-411	Lockwasher
		-----*-----

CHASSIS ASSY
PART NUMBER 893371
FIGURE 6-9 (Continued)

ITEM NUMBER	PART NUMBER	DESCRIPTION
	793678	Panel Assy, Front
43	693675	Screw, Set
44	293269	Shape, Extruded Rubber
45	893609	Panel Front
46	893604	Support Assy, Roller
		(A-P)
	31-119920-6204	Screw, Mach Fl Ad
	694008	Nut Assy, Floating
		-----*-----
47	393599-1	Cap End
48	270903-11	Clip Adhesive
	694126	Cable Assy 12V Pwr.
49	265840-2	Lug, Quick Disconnect
50	281506-1	Contact
51	9-281501-22	Connector
52	270903-15	Clip, Adhesive
53	270903-12	Clip, Adhesive
54	893605	Panel Assy, L.H. Side
		(A-P)
	31-119918-8206	Screw, Mach
		-----*-----
55	269950	Wire, Cable

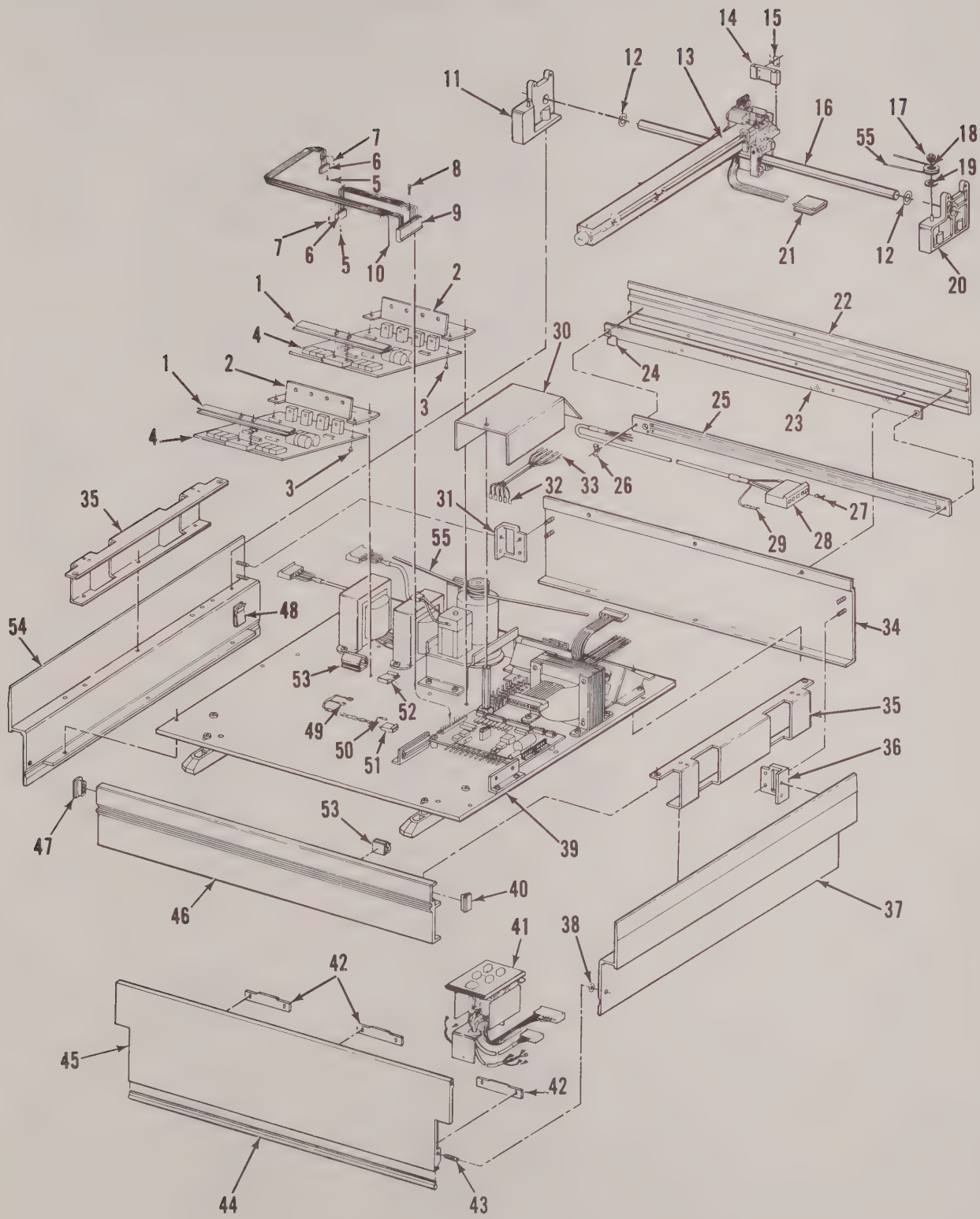


FIGURE 6-9 CHASSIS ASSY 893371

DRIVE AMPLIFIER BOARD SUB-ASS'Y
PART NUMBER 893230-1 (X-Axis) & 893230-2 (Y-AXIS)
ELECTRONIC COMPONENTS ONLY
FIGURE 6-10

SYMBOL NUMBER	PART NUMBER	DESCRIPTION	USED ON
C1, C2	35-281295-228	Capacitor, 2200 μf	-1, -2
C3, C4	231922-106	Capacitor, 10 μf	-1, -2
C5, C6	281509-477	Capacitor, 500 μf	-1, -2
C7-C10	262585-106	Capacitor, 10 μf	-1, -2
C11	5-241145-144	Capacitor, 0.14 μf	-1
C11	5-241145-224	Capacitor, 0.22 μf	-2
C12	281344-103	Capacitor, 0.01 μf	-1, -2
C13	10-241145-403	Capacitor, 0.04 μf	-1, -2
C14, C15	262585-106	Capacitor, 10 μf	-1, -2
C16	240352-151	Capacitor, 150 pf	-1, -2
C18	240352-151	Capacitor, 150 pf	-1, -2
C19, C20	262585-106	Capacitor, 10 μf	-1, -2
C21, C22	240352-300	Capacitor, 30 pf	-1, -2
C25	10-241145-224	Capacitor, 0.22 μf	-1, -2
C26	10-247116-153	Capacitor, 0.015 μf	-1, -2
C27	10-241145-683	Capacitor, 0.068 μf	-1, -2
CR3-CR6	270508	Diode, IN4454	-1, -2
CR9, CR10	1-230061-8	Diode, Zener, IN4737	-1, -2
CR11, CR12	280440	Diode, IN4148	-1, -2
CR13, CR14	269256-7	Diode, IN4007	-1, -2
CR15, CR16	1-230061-5	Diode, Zener, IN4747A	-1
CR15, CR16	244477-3	Diode, Zener, IN962B	-2
CR17	265420-1	Rectifier, Bridge, VS248	-1, -2
CR18	282295-5	Rectifier, Bridge, VE-28	-1, -2
F1, F2	102625-9	Fuse, 3A, 3AG	-1
F1, F2	102625-8	Fuse, 1.50A, 3AG	-2
F1-C, F2-C	285577	Clip, Fuse	-1, -2
J1	281711-6	Connector	-1, -2
J2	281711-3	Connector	-1, -2
J3	1-287495-5	Connector	-1, -2
J4	2-283409-20	Connector	-1, -2
J5	1-287495-6	Connector	-1, -2
Q1	281850-1	Transistor, MPSA66	-1, -2
Q2	281848-1	Transistor, MPSA14	-1, -2
Q3	281702-2	Transistor 2N4401	-1, -2
Q4	281703-2	Transistor, 2N4403	-1, -2
Q5	282627-4	Transistor, MJE1093	-1, -2
Q6, Q7	282627-8	Transistor, MJE1103	-1, -2
Q8	282627-4	Transistor, MJE1093	-1, -2

DRIVE AMPLIFIER BOARD SUB-ASS'Y
PART NUMBER 893230-1 (X-Axis) & 893230-2 (Y-AXIS)
ELECTRONIC COMPONENTS ONLY
FIGURE 6-10 (Continued)

SYMBOL NUMBER	PART NUMBER	DESCRIPTION	USED ON
R1A	1-265969-26701	Resistor, 26.7K	-1
R1B	293957-104	Resistor, Variable, 100K	-2
R2	5-241111-105	Resistor, 1 Meg	-1, -2
R3, R4	1-265969-10001	Resistor, 10K	-1, -2
R5	282299-203	Resistor, Variable, 20K	-1, -2
R6	1-265969-90901	Resistor, 90.9K	-1, -2
R7	1-265969-10002	Resistor, 100K	-1, -2
R8	1-265969-63401	Resistor, 63.4K	-1, -2
R9	1-265969-10002	Resistor, 100K	-1, -2
R10	5-241111-473	Resistor, 47K	-1, -2
R11, R12	282299-202	Resistor, Variable, 2K	-1, -2
R13, R14	1-265969-30100	Resistor, 3.01K	-1, -2
R15	1-265969-17800	Resistor, 1.78K	-1, -2
R16	1-265969-49901	Resistor, 49.9K	-1, -2
R17	1-265969-10002	Resistor, 100K	-1, -2
R18	282299-202	Resistor, 2K	-1, -2
R19	5-241111-102	Resistor, 1K	-1, -2
R20	5-241111-333	Resistor, 33K	-1, -2
R21	5-241111-152	Resistor, 1.5K	-1, -2
R22	282299-202	Resistor, 2K	-1, -2
R23	5-241111-683	Resistor, 68K	-1, -2
R24	282299-103	Resistor, 10K	-1, -2
R25	5-241111-184	Resistor, 180K	-1, -2
R26	5-115557-222	Resistor, 2.2K	-1, -2
R27	5-241111-474	Resistor, 470K	-1, -2
R28	5-241111-683	Resistor, 68K	-1, -2
R29, R30	5-241111-560	Resistor, 56 ohm	-1, -2
R31, R32	1-265969-15001	Resistor, 15K	-1, -2
R33	5-115557-221	Resistor, 220 ohm	-1, -2
R34	5-115557-331	Resistor, 330 ohm	-1, -2
R35	5-115557-222	Resistor, 2.2K	-1, -2
R36	5-115557-331	Resistor, 330 ohm	-1, -2
R37, R38	5-241111-331	Resistor, 330 ohm	-1, -2
R39	5-241111-105	Resistor, 1 Meg	-1, -2
R41, R42	5-115557-471	Resistor, 470 ohm	-1
R41, R42	5-115557-102	Resistor, 1 K	-2
R43	5-241111-104	Resistor, 100 K	-1, -2
R44, R45	5-241111-474	Resistor, 470 K	-1, -2
SW1	1-270694-1	Switch, SPDT	-1, -2
TP1-TP13	265763-3	Contact, Elec.	-1, -2
U1, U2	283948	OP. Amp, MC1458	-1, -2
U3	293849-3	Regulator, AD2702JD	-1, -2

DRIVE AMPLIFIER BOARD SUB-ASS'Y
PART NUMBER 893230-1 (X-Axis) & 893230-2 (Y-AXIS)
ELECTRONIC COMPONENTS ONLY
FIGURE 6-10 (Continued)

SYMBOL NUMBER	PART NUMBER	DESCRIPTION	USED ON
U3-S	284549-2	Socket, I.C., 14 Pin	-1, -2
VR1	285461	Regulator, MC7815	-1, -2
VR2	285778	Regulator, MC7915	-1, -2
VR1-H, VR2-H	293324-1	Heatsink (A-P)	-1, -2
	31-119914-4006	Screw	-1, -2
	1-120053-201	Lockwasher	-1, -2
	31-119998-40	Nut, Hex	-1, -2
		—————*—————	
VR1-K, VR2-K	292900	Kit, Insulation	-1, -2

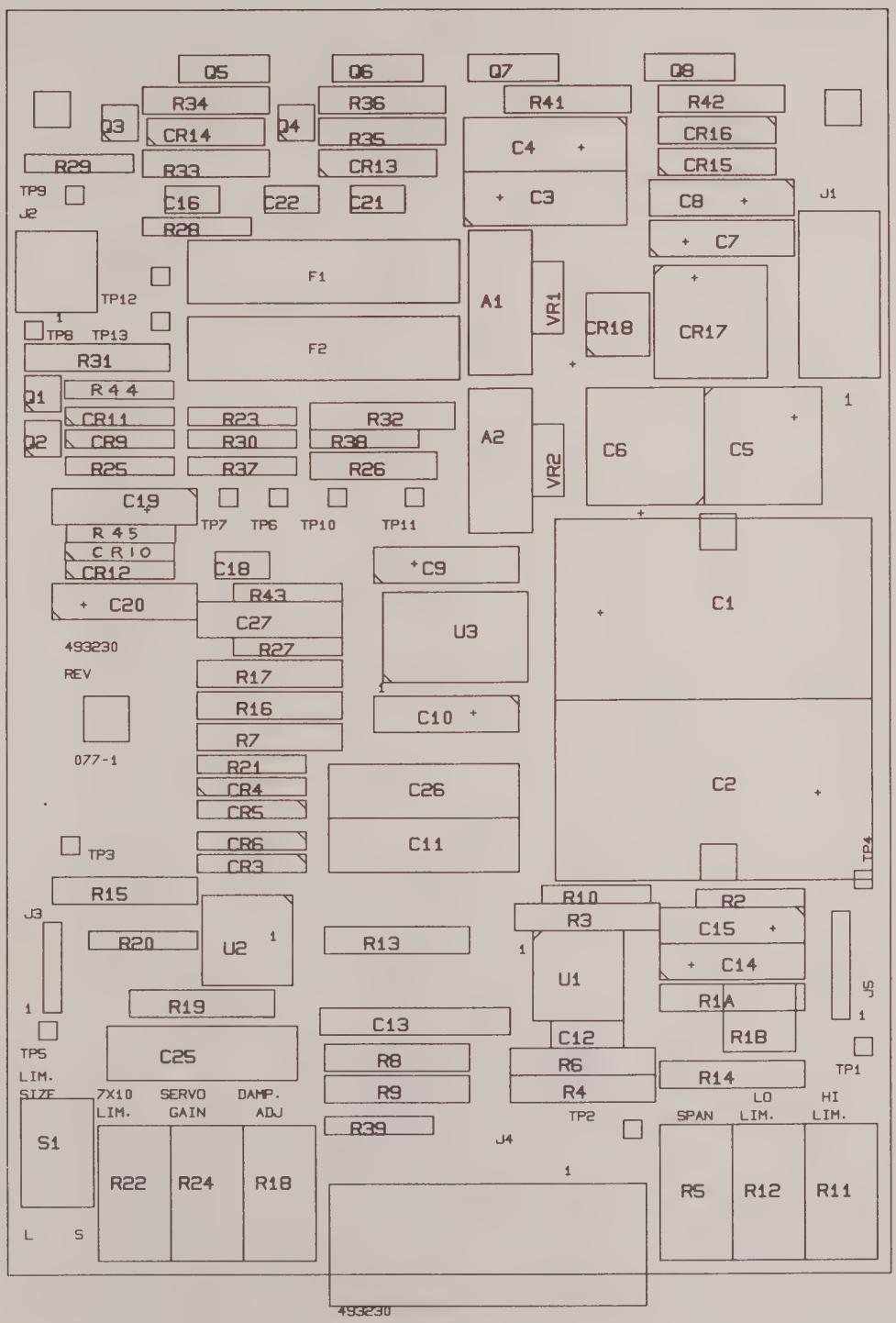


FIGURE 6-10 DRIVE AMP BOARD SUB-ASSY

TROLLEY & ARM ASSY
PART NUMBER 893818
FIGURE 6-11

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER
	894102	Cable Assy, Y-Axis (A-P)	
	31-119918-2603	Screw, Mach	
	1-216741-402	Lockwasher	
	243104-1	Washer, Non-Metallic (Place between items 1 & 28)	
		-----*-----	
1	893196	P.C. Board Assy	
2	269256-5	Diode (IN4005)	CR-1
3	294015	Clamp (A-P)	
	31-119918-2605	Screw, Machine	
	1-216741-401	Washer, Spring	
	31-119998-26	Nut, Hex	
		-----*-----	
4	265840-1	Lug, Quick Disconnect	
5	281504	Key	
6	281502	Contact	
7	9-281501-5	Connector	
8	9-281501-3	Connector	
9	287490	Contact	
10	287491-5	Connector	
11	287489	Key	
12	232997-23	Strap, Retaining	
13	294406	Block (A-P)	
	31-119922-2610	Screw, Mach	
		-----*-----	
14	294476	Sleeve	
15	269950	Wire, Cable	
	693672	Post Assy, Stop	
16	293362	Post, Stop	
17	244300-9	'O'- Ring	
18	293813	Capstan, Drive (A-P)	
	245203-4002	Screw, Set	
		-----*-----	
19	793601	Cover Assy, Y-Axis (See Fig. 6-12) (A-P)	
	31-119918-2604	Screw, Mach	
	1-216741-402	Washer, Flat	
		-----*-----	
20	694081	Motor Assy (A-P)	
	31-119918-2604	Screw, Mach	
	1-216741-402	Lockwasher	
		-----*-----	

TROLLEY & ARM ASSY
PART NUMBER 893818
FIGURE 6-11 (Continued)

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER
20 (continued)			
	293942	Motor	
	393494	Plate, Motor Mounting (A-P)	
	31-119918-4003	Screw	
		-----*-----	
	894084	Trolley Assy	
21	393484-2	Support, Bearing (A-P)	
	1-1188195-303	Washer	
	31-119924-2604	Screw, Hex Hd.	
		-----*-----	
22	240161-414	Pin, Straight	
23	281513-4	Bearing, Ball (A-P)	
	1-227070-3	Ring, Retaining	
		-----*-----	
24	693898	Bearing & Bushing Assy (A-P)	
	31-119922-2606	Screw, Soc. Hd.	
	31-119998-26	Nut, Hex	
	1-216741-401	Washer, Locking	
		-----*-----	
25	393484-1	Support, Bearing (A-P)	
	1-118195-303	Washer	
	31-119924-2604	Screw, Hex Hd.	
		-----*-----	
26	293368	Take-Up, Wire (A-P)	
	245203-6206	Screw, Set	
		-----*-----	
27	230776-26	Screw, Set	
		-----*-----	
28	893612	Frame, Trolley	
29	13-121166-2604	Screw, Set	
30	31-119923-2603	Screw, Set	
31	894085	Arm Assy, Y-Axis (See Fig. 6-13)	
32	293270	Wiper Assy (A-P)	
	31-119914-2602	Screw, Mach	

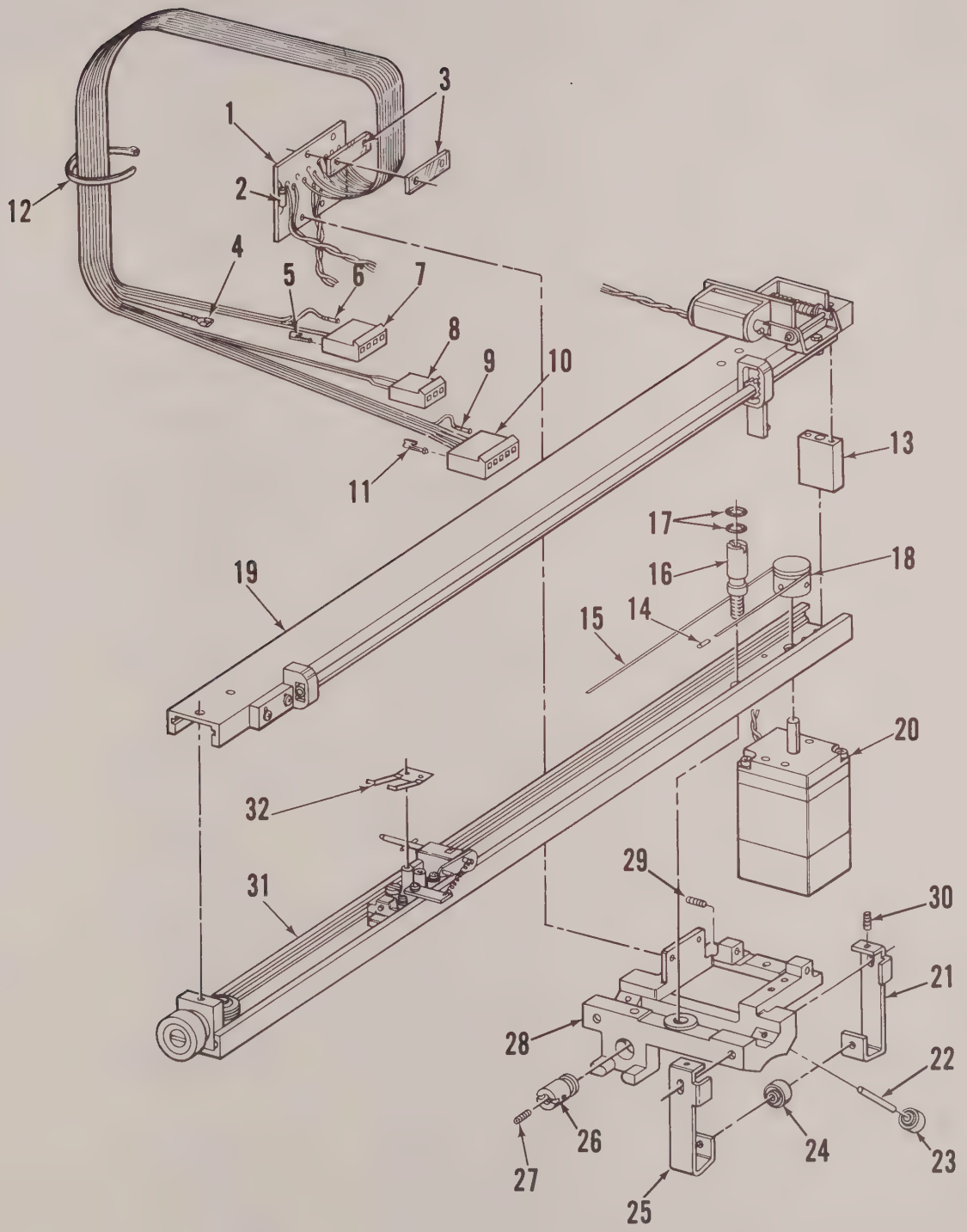


FIGURE 6-11 TROLLEY & ARM ASSY 893818

COVER ASSY, Y-AXIS
PART NUMBER 793601
FIGURE 6-12

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER
	793601	Cover Assy, Y-Axis	
1	294401	Link	
2	1-243150-1	Pin, Spring	
3	293856	Solenoid, Pull (A-P)	
	31-119918-1202	Screw, Pan Hd.	
	236562-2	Washer, Flat	
		-----*-----	
4	294703	Collar (A-P)	
	31-121166-0001	Screw, Set	
		-----*-----	
5	394424	Bracket, Solenoid (A-P)	
	31-119918-2603	Screw, Pan Hd.	
	1-216741-402	Lockwasher	
	31-119998-26	Nut, Hex	
		-----*-----	
6	294420	Rod	
7	294422	Pin (A-P)	
	3-240731-18	Ring, Retaining	
8	1-264521-14	Spring, Compression	
9	294423	Arm (A-P)	
	230822-00	Nut, Self-Locking	
	31-119917-0005	Screw, Mach	
		-----*-----	
10	294218	Retainer	
11	394426	Rack, Rear (A-P)	
	31-119918-2603	Screw, Pan Hd.	
	2-118195-103	Washer, Flat	
		-----*-----	
12	694418	Shaft Assy	
13	394425	Rack, Front (A-P)	
	31-119918-2604	Screw, Pan Hd.	
	1-216741-402	Lockwasher	
	295140	Washer, Plate	
		-----*-----	
14	392568	Element, Resistive (A-P)	
	31-119920-2603	Screw, Flat Head	
		-----*-----	
15	793497	Shield, Element	
16	793485	Cover, Arm	

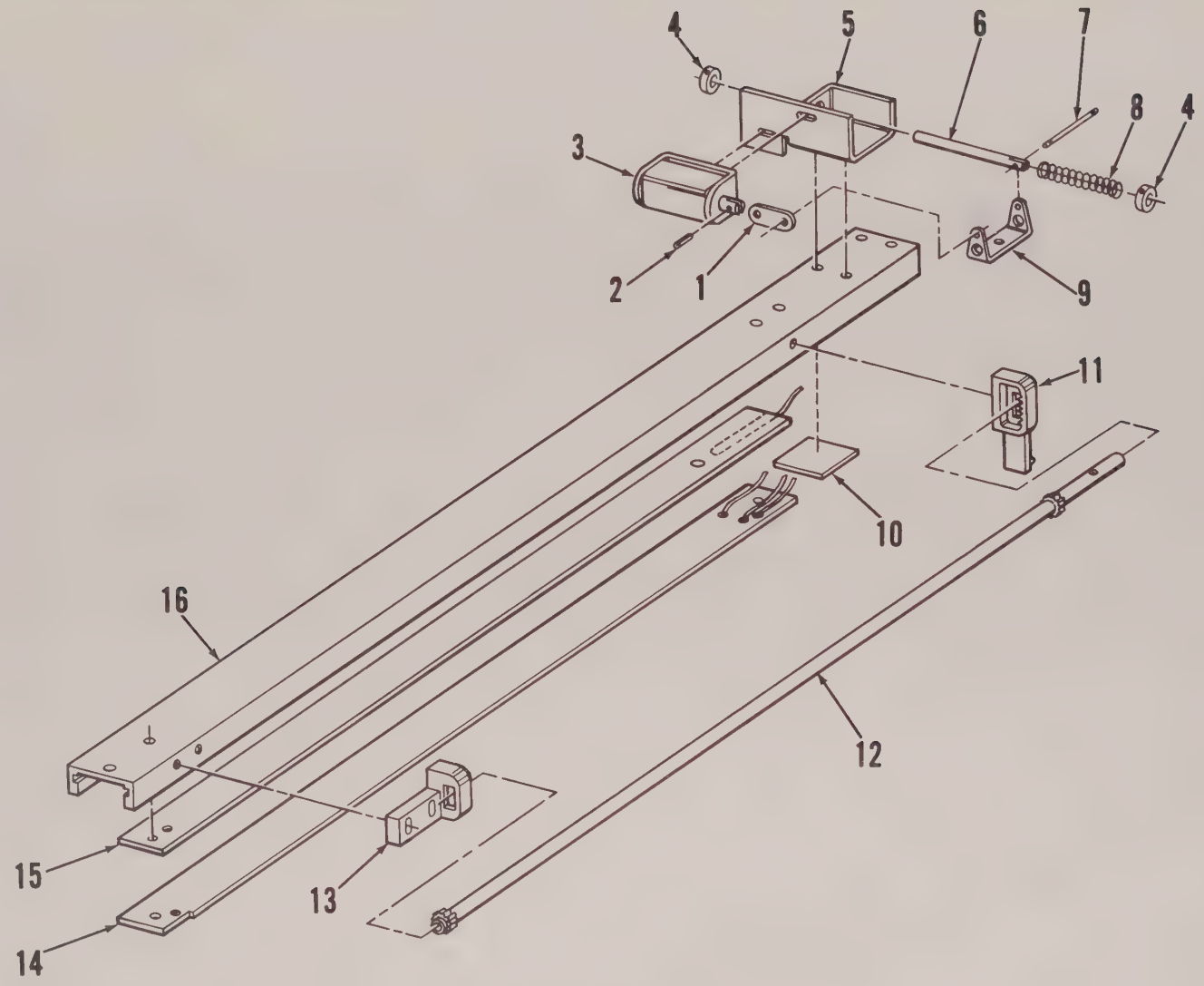


FIGURE 6-12 COVER ASSY, Y-AXIS 793601

ARM ASSY, Y-AXIS
PART NUMBER 894085
FIGURE 6-13

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER
	693549	Roller Assy (A-P)	
	31-119920-2603	Screw, Mach.	
		-----*-----	
1	128018-6207	Screw, Flat Head	
2	293370	Shaft, Bearing	
3	293364	Roller	
4	293367	Support, Bearing	
	693673	Spacer Assy, Bearing (A-P)	
	31-119920-4004	Screw, Mach	
		-----*-----	
5	293369	Spacer, Bearing	
6	244300-8	'O' Ring	
7	693587	Pulley Assy (A-P)	
	1-227070-2	Ring, Retaining	
		-----*-----	
	793676	Shuttle Assy	
8	261828-2603	Screw, Set	
9	31-119923-4003	Screw, Set	
10	393531	Shuttle, Slide	
11	293365	Y-Axis, Wire Take-Up	
12	236562-2	Washer, Flat (A-P)	
	31-119914-1204	Screw	
		-----*-----	
13	493532	Shuttle	
14	294403	Collar (A-P)	
	31-121166-0001	Screw, Set	
		-----*-----	
15*	395539	Holder, Pen Cartridge Assy (A-P)	
	13-121166-2604	Screw, Set	
		-----*-----	
16	794357	Shaft Assy	
17	1-240031-13	Spring, Ext	
18	294360	Arm	
19	893625	Arm Assy, Lower	

*This part is not included with the 793676 Shuttle Assembly, but is included with the 894085 Y-Axis Arm Assembly.

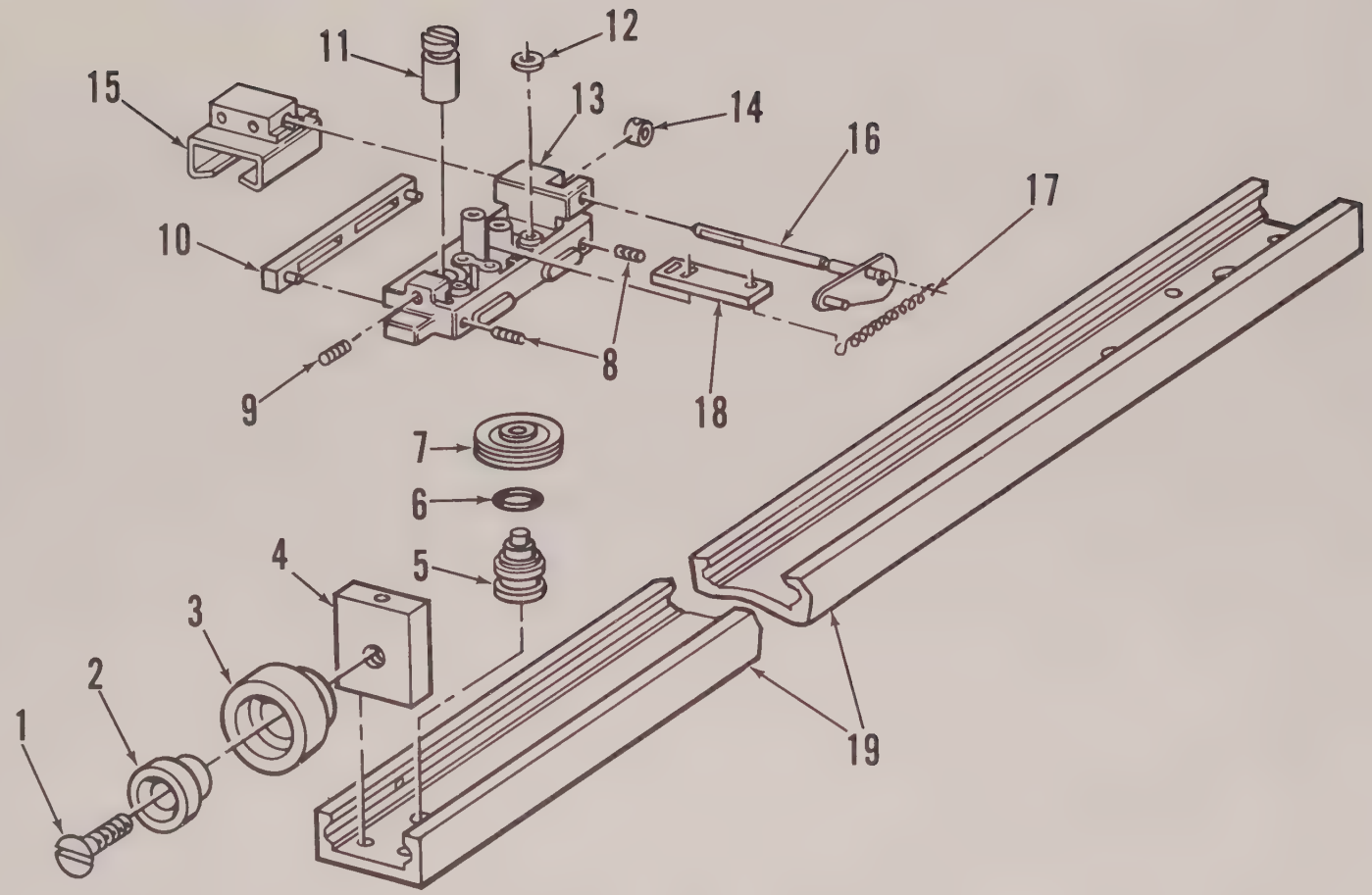


FIGURE 6-13 ARM ASSY, Y-AXIS 894085

PLATE ASSY, BOTTOM
PART NUMBER 893372
FIGURE 6-14

ITEM NUMBER	PART NUMBER	DESCRIPTION
	793232	Drive Assy, X-Axis
		(A-P)
	13-262716-8206	Screw, Self-Tapping
		------*------
1	269945-20	Belt, Timing
2	294079-1	Pulley, Timing Belt
3	1-282930-8	Pulley, Timing Belt
4	293555	Shaft
5	262565-1	Washer
6	393489	Mount, Motor
	693903	Motor
		(A-P)
	31-119918-4006	Screw
	10-120053-102	Washer, Lock, Ext.
		------*------
7	293942	Motor
8	281506-2	Contact
9	9-281501-3	Connector
10	281504	Key
11	293553	Capstan
		(A-P)
	14-119923-8204	Screw, Set
		------*------
	693901	Housing Assy, Bearing
		(A-P)
	31-119918-4006	Screw
	1-216741-411	Washer, Lock
		------*------
12	265741-1	Bearing, Ball
13	233554	Housing, Bearing
	794049	Transformer Assy, Drive
		(A-P)
	13-262716-8206	Screw, Self-Tapping
		------*------
14	281504	Key
15	9-281501-6	Connector
16	281506-1	Contact
17	265840-2	Lug
18	285706	Transformer
	794018	Panel Assy, Power & Signal Input (items 19-31)
		(A-P)
	13-262716-6204	Screw, Self-Tapping
		------*------
	794004	Cable Assy, Signal Input (X: -1 for Y, -2 for X)
19	230769-19	Washer, Insul. Shoulder
20	265745-6	Washer, Insul.
21	285315	Jack, Phone
22	265760-1	Contact

PLATE ASSY, BOTTOM
PART NUMBER 893372
FIGURE 6-14 (Continued)

ITEM NUMBER	PART NUMBER	DESCRIPTION
23	270903-15	Clip, Adhesive
	694003	Cable Assy, Remote Control
		(A-P)
	31-119918-4005	Screw, Mach.
	31-119998-40	Nut, Hex
	1-216741-411	Lockwasher
		——————*——————
24	281504	Key
25	9-281501-7	Connector, Female
26	281506-1	Contact, Elect, Male
27	245538	Connector, 15 Cont
28	265840-2	Term Lug
29	293954	Recept. Line Power Module
30	126395-3	Post, Binding
31	393894	Housing, Connector
31A	289677	Cord, Elastic 11" ±¼" long
		(A-P)
	13-262716-6208	Screw, Self Tapping
	1-118195-305	Washer, Flat
	1-118195-309	Washer, Flat
	232997-23	Strap, Retaining Cable
		——————*——————
32	294014	Bracket
		(A-P)
	13-262716-4006	Screw, Self-Tapping
		——————*——————
33	694008	Nut Assy, Floating
	794048	Transformer Assy, Power
		(A-P)
	13-262716-8206	Screw, Self-Tapping
		——————*——————
34	281504	Key
35	281501-8	Connector
36	281506-1	Contact
37	265840-2	Lug
38	794048	Transformer
39	294179	Spacer
40	265814-8	Terminal Board
		(A-P)
	13-262716-4008	Screw, Self Tapping
		——————*——————
	794292-14	Wire Assembly
41	104795-19	Terminal Lug
42	265840-2	Terminal Lug
43	893867 (for Analog Time Base)	Board Assy, Misc. Power (See Fig. 6-21)
	894550 (for Digital Time Base)	Board Assy, Misc. Power (See Fig. 6-25)
		(A-P)
	31-119918-4004	Screw, Mach
	1-216741-411	Lockwasher
	1-118195-304	Flatwasher
		——————*——————
44	264080	Bumper, Rubber
		(A-P)
	31-119918-0210	Screw, Self-Tapping
		——————*——————

PLATE ASSY, BOTTOM
PART NUMBER 893372
FIGURE 6-14 (Continued)

ITEM NUMBER	PART NUMBER	DESCRIPTION
45	4-266107-5	Bail Assy
		(A-P)
	13-262716-6208	Screw, Self Tapping
		-----*-----
46	13-262716-4004	Screw, Self-Tapping
47	694059	Bracket Assy, R.H.
48	694060	Bracket Assy, L.H.
		(A-P)
	13-262716-4006	Screw, Self-Tapping
		-----*-----
49	393486	Lever, Locking
		(A-P)
	31-119918-8207	Screw, Self-Tap
	1-118195-307	Washer, Flat
	1-216741-425	Lockwasher
		-----*-----
50	293866	Spacer
		(A-P)
	31-119918-8204	Screw
	1-118195-307	Washer, Flat
	1-216741-425	Lockwasher
		-----*-----
51	893611	Plate Assy, Bottom
52	794470	Label Assy, Silkscreen

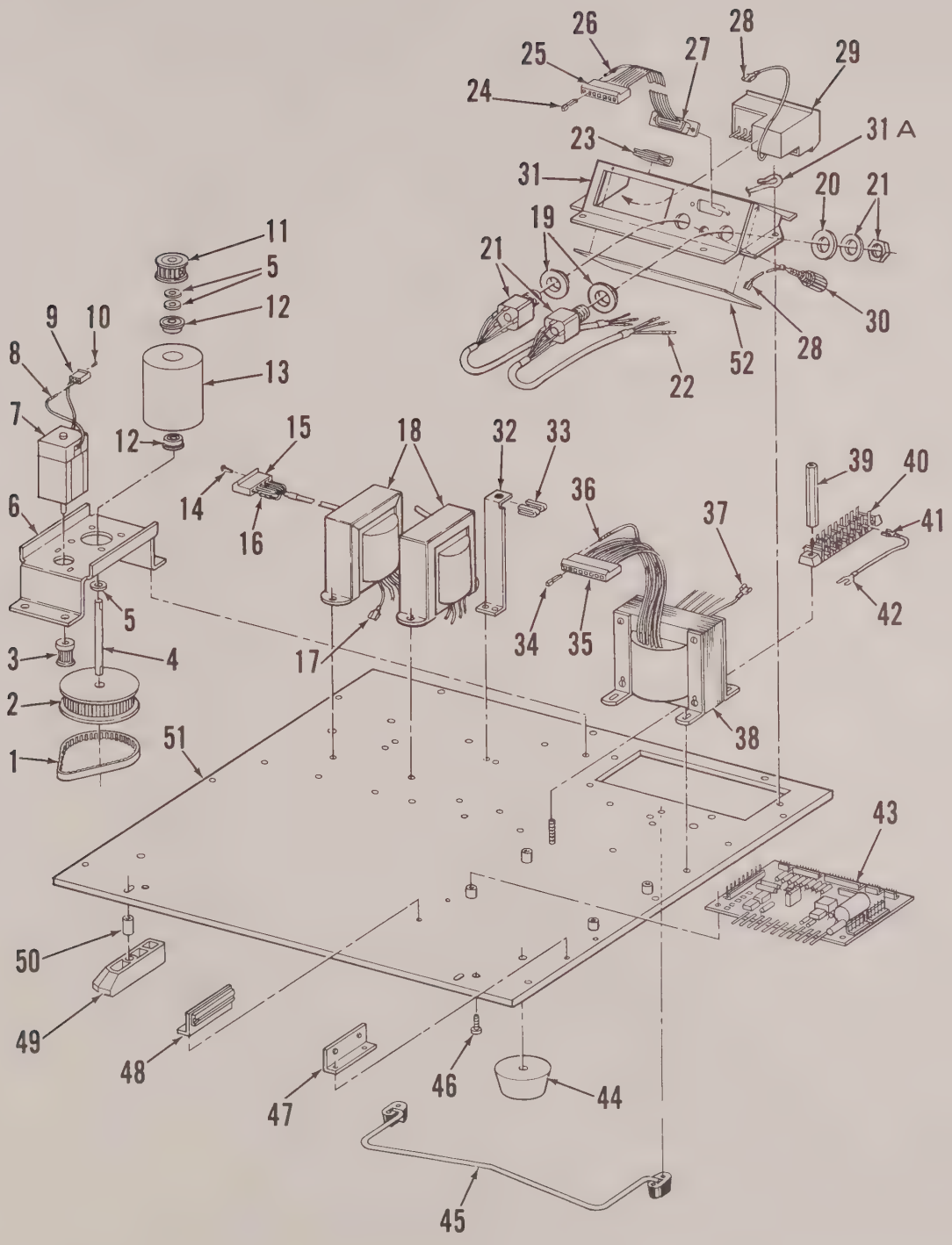


FIGURE 6-14 PLATE ASSY, BOTTOM 893372

PANEL ASSY, SWITCH
PART NUMBER 894202
FIGURE 6-15

ITEM NUMBER	PART NUMBER	DESCRIPTION	SYMBOL NUMBER
1	794204	Panel, Silkscreen	
	694091	Sub-Assy, Pilot Light	
2	285766-1	Lampholder, w/Nut	
3	285765-3	Lamp (12V)	
4	285764-1	Lens (White)	
5	265840-1	Lug, Quick-Disconnect	
6	393507	Shield (A-P)	
	31-280427-4004	Screw	
		------*------	
7	270121-2	Tubing, Superthane, 1½ ±¼" long.	
	894167	Harness Assy, Power Control (A-P)	
	13-262716-2604	Screw	
		------*------	
	894139	Board Assy, Power Cont.	
	269256-7	Diode (IN4007)	CR1, CR2
	5-115557-474	Resistor (470K)	R-1 thru R-4
8	293947	Switch, Push Button (A-P)	S1; S2
	230822-26	Nut	
	31-119918-2604	Screw	
		------*------	
9	494139	Board P.C.	
10	281504	Key, Polarizing	
11	9-281501-6	Connector	P-4
12	281502	Contact, Elect	
13	232997-23	Strap, Retaining	
14	265840-1	Lug	
15	1-291528-1	Lug, Terminal-Insul.	
16	2-291410-1	Contact, Elect.	
17	9-281501-8	Connector	P-8
18	293949	Switch, Push Button	S3; S4
19	232997-26	Strap, Retaining Cable	
20	232997-23	Strap, Retaining Cable	

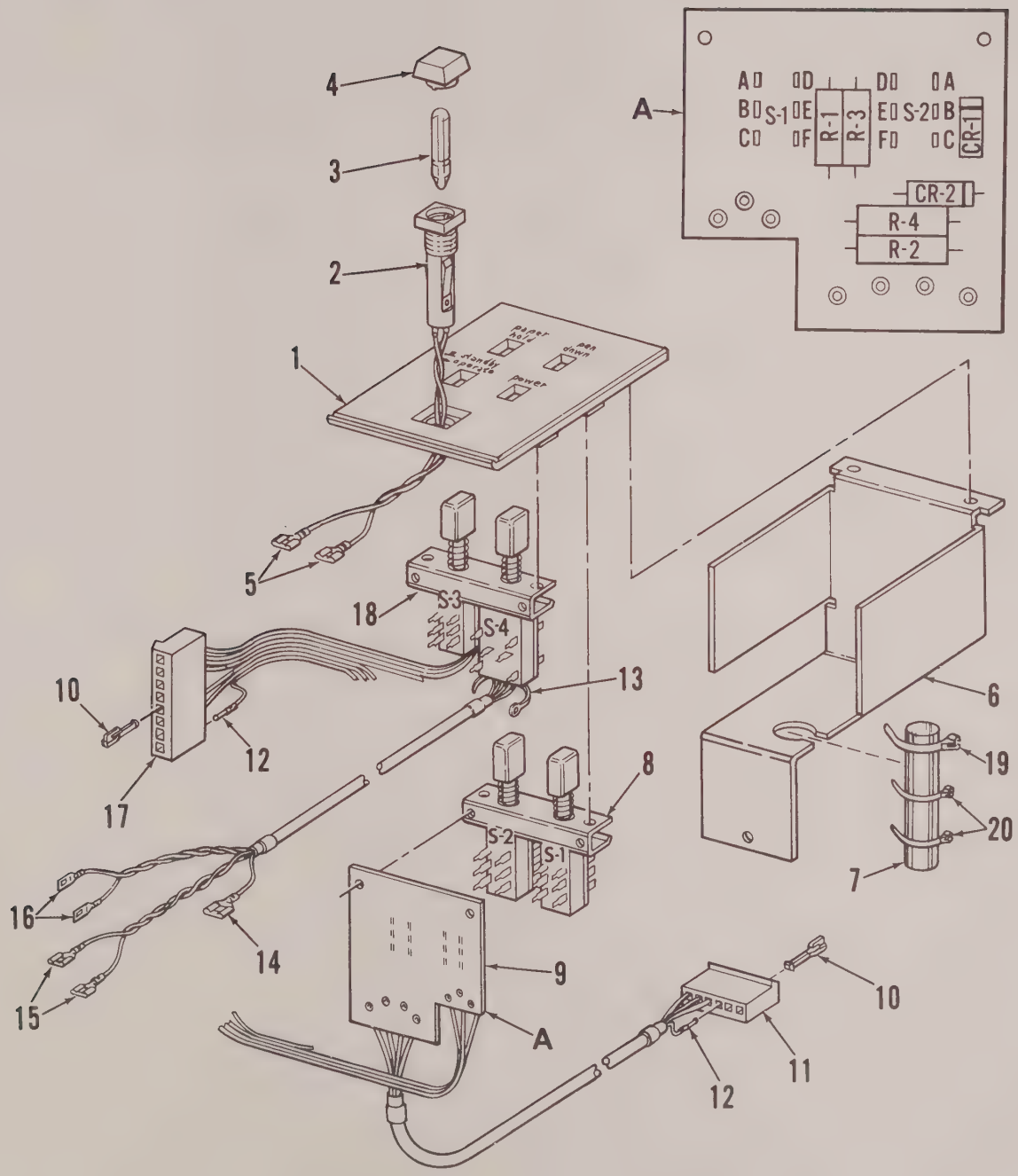


FIGURE 6-15 PANEL ASSY, SWITCH 894202

LOGIC BOARD ASSY*
PART NUMBER 893872
FIGURE 6-16

SYMBOL NUMBER	PART NUMBER	DESCRIPTION
C1, C2	287618-476	Capacitor, 47μf
C3, C4	20-263695-106	Capacitor, 10μf
C5	288755-104	Capacitor, 0.1μf
C6	288755-103	Capacitor, 0.01μf
CR1, CR2	280440	Diode IN4148
J1	1-292529-26	Connector
J2	9-283766-10	Connector
R1	5-241111-152	Resistor, 1.5K
R2	5-241111-224	Resistor, 220K
U1	293945	I.C. Regulator LM325
U2	282295-5	Rectifier, Bridge VE28
U3	291305	OP Amp LM311
U4	285569	Isolator MCT2
U5	281105	I.C., Dual D F/F 7474
U6	270513	I.C., Quad Nand 7401
U7	2-283274-103	Resistor Pack 10K
U1-A	694539	Regulator Ass'y (Alternate for U1)
U1-S	285593-14	Socket, 14 Pin DIP (for U1)

NOTE: This board used only on Analog Time Base type units (shipped thru October, 1981).

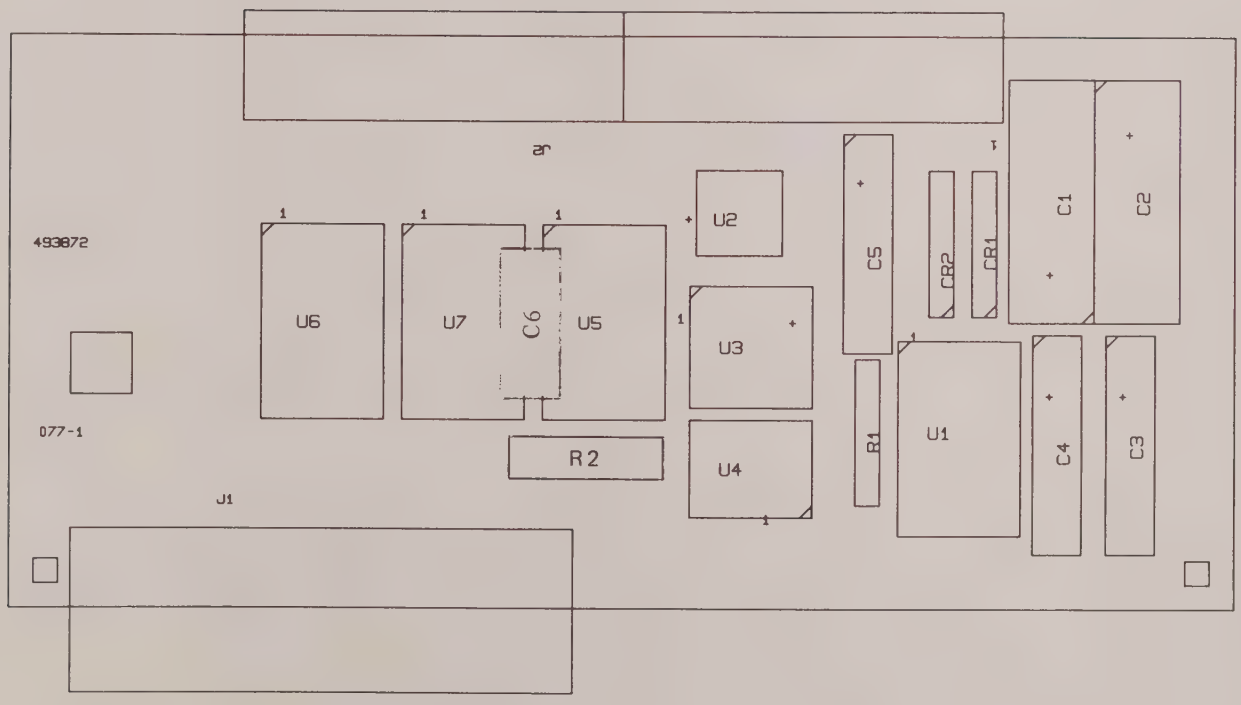


FIGURE 6-16 LOGIC BOARD ASSY 893872

PREAMP ASSY, 3054,Y AXIS
PART NUMBER 893900-X
FIGURE 6-17

ITEM NUMBER	PART NUMBER	DESCRIPTION	USED ON
	893900-1	Preamp Assy, Y-Axis (English)	A
	893900-2	Preamp Assy, Y-Axis (Metric)	B
1	294075	Guard, Link	A, B
2	286006-6	Binding, Post	A, B
3	286006-10	Binding Post	A, B
4	286006-2	Binding Post	A, B
5	694245	Knob Assy, Locking (A-P)	A, B
	1-293279-1	Nut	A, B
		_____*_____	
6	285651-16	Knob	A, B
7	285651-3	Knob	A, B
8	794177-2	Panel Assy, Silkscreen (English)	A
	794178-2	Panel Assy, Silkscreen (Metric) (A-P)	B
	31-119918-4006	Screw	A, B
	1-103838-12	Nut	A, B
		_____*_____	
	865693-40	Cable Assy, Input	A, B
9	265760-1	Contact, Elect	A, B
	793916	Harness Assy, Pen Pos/Sen	A, B
10	287490	Contact, Elect	A, B
11	287491-10	Connector	A, B
12	287489	Key, Polarizing	A, B
13	293271-2	Resistor, Variable 50K	A, B
14	293946-503	Resistor, Variable 50K	A, B
15	893707-1	Board Assy, Preamp ® (English)	A
	893707-2	Board Assy, Preamp ® (Metric) (A-P)	B
	13-262716-2604	Screw	A, B
		_____*_____	
16	883878-23	Cable Assy, Flat	A, B
	2-292531-20	Connector	A, B
	282356-3	Label, Up	A, B
17	793508	Shield, Y-Axis Pre-Amp	A, B
18	265840-1	Lug, Terminal	A, B
19	270270-2	Lug (A-P)	A, B
	230822-40	Nut, Lock	A, B
	5-120053-101	Lockwasher (place between items 17 & 19)	A, B
	31-119914-4004	Screw, Mach.	A, B
		_____*_____	
20	1-293955-1	Spacer, P.C.	A, B
21	893708-1	Board Assy, Filter (See Fig. 6-20)	A, B

® See Figure 6-19

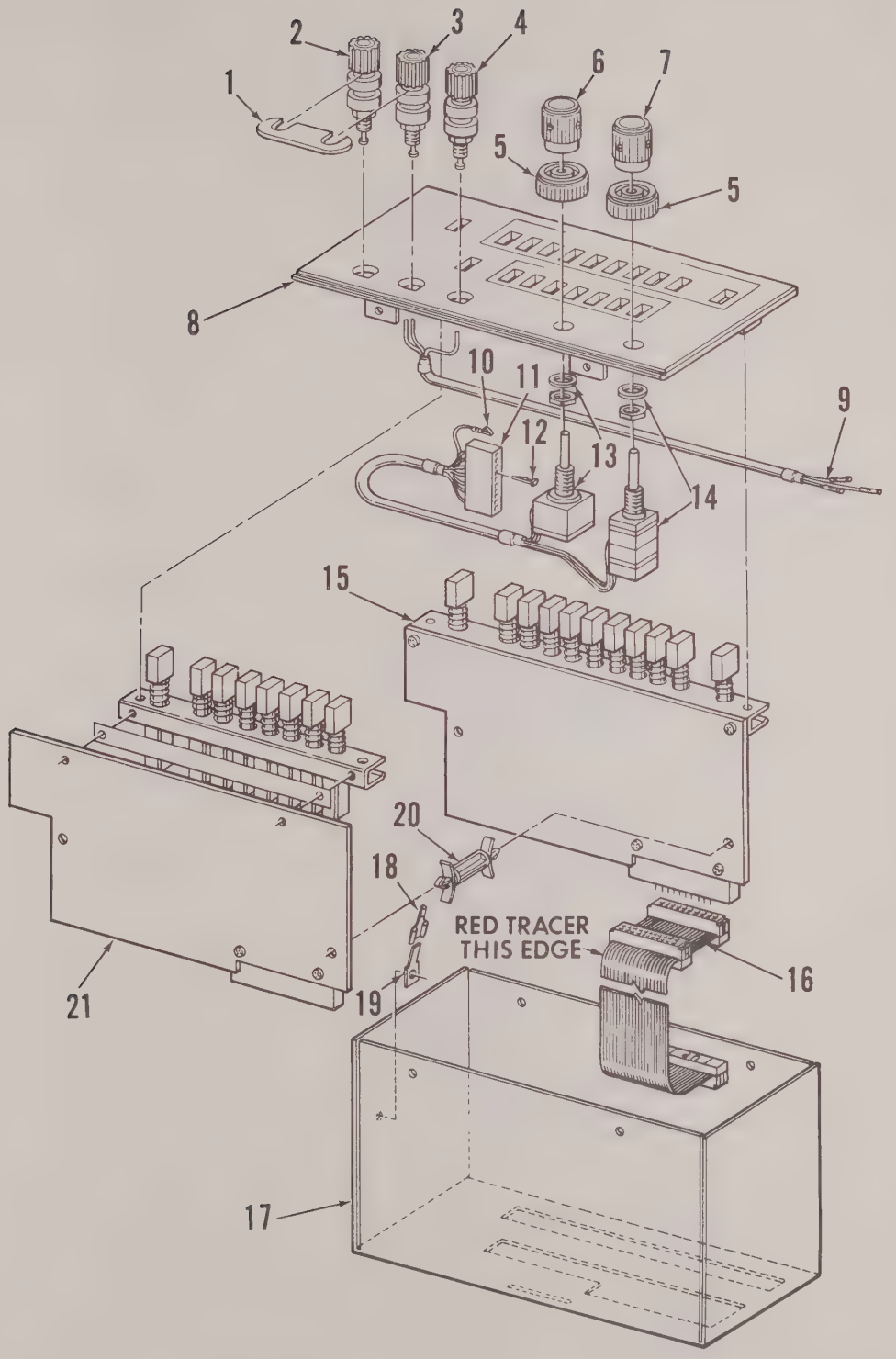


FIGURE 6-17 PREAMP ASSY, 3054, Y-AXIS 893900-X

PREAMP ASSY, 3054, X AXIS
PART NUMBER 893226-X
FIGURE 6-18

ITEM NUMBER	PART NUMBER	DESCRIPTION	USED ON
	893226-1	Pre Amp Assy X-Axis (English)	A
	893226-2	Preamp Assy X-Axis (Metric)	B
1	294075	Guard, Link	A, B
2	286006-6	Binding Post	A, B
3	286006-10	Binding Post	A, B
4	286006-2	Binding Post	A, B
5	694245	Knob Assy, Locking (A-P)	A, B
	1-293279-1	Nut	A, B
		-----*-----	
6	285651-16	Knob	A, B
7	285651-3	Knob	A, B
8	794177-1	Panel Assy, Silkscreen (English)	A
	794178-1	Panel Assy, Silkscreen (Metric) (A-P)	B
	31-119918-4006	Screen	A, B
	1-103838-12	Nut	A, B
		-----*-----	
	865693-40	Cable Assy, Input	A, B
9	265760-1	Contact, Electrical	A, B
	793916	Harness Assy, Pen Pos/Sen.	A, B
10	287490	Contact, Electrical	A, B
11	287491-10	Connector	A, B
12	287489	Key, Polarizing	A, B
13	293271-2	Resistor, Variable 50K	A, B
14	293946-503	Resistor, Variable 50K	A, B
15	893707-1	Board Assy, Preamp ⊛ (English)	A
	893707-2	Board Assy, Preamp ⊛ (Metric) (A-P)	B
	13-262716-2604	Screw	A, B
		-----*-----	
16	883878-23	Cable Assy, Flat	A, B
	2-292531-20	Connector	A, B
	2-282356-3	Label, Up	A, B
17	793509	Shield, X-Axis Pre-Amp	A, B
18	265840-1	Lug, Terminal	
19	270270-2	Lug (A-P)	A, B
	230822-40	Nut, Lock	A, B
	5-120053-101	Lockwasher (place between items 17 & 19)	A, B
	31-119914-4004	Screw, Mach.	A, B
		-----*-----	
20	1-293955-1	Spacer, P.C.	A, B
21	893708-1	Board Assy, Filter (See Fig. 6-20)	A, B

⊛ See Figure 6-19

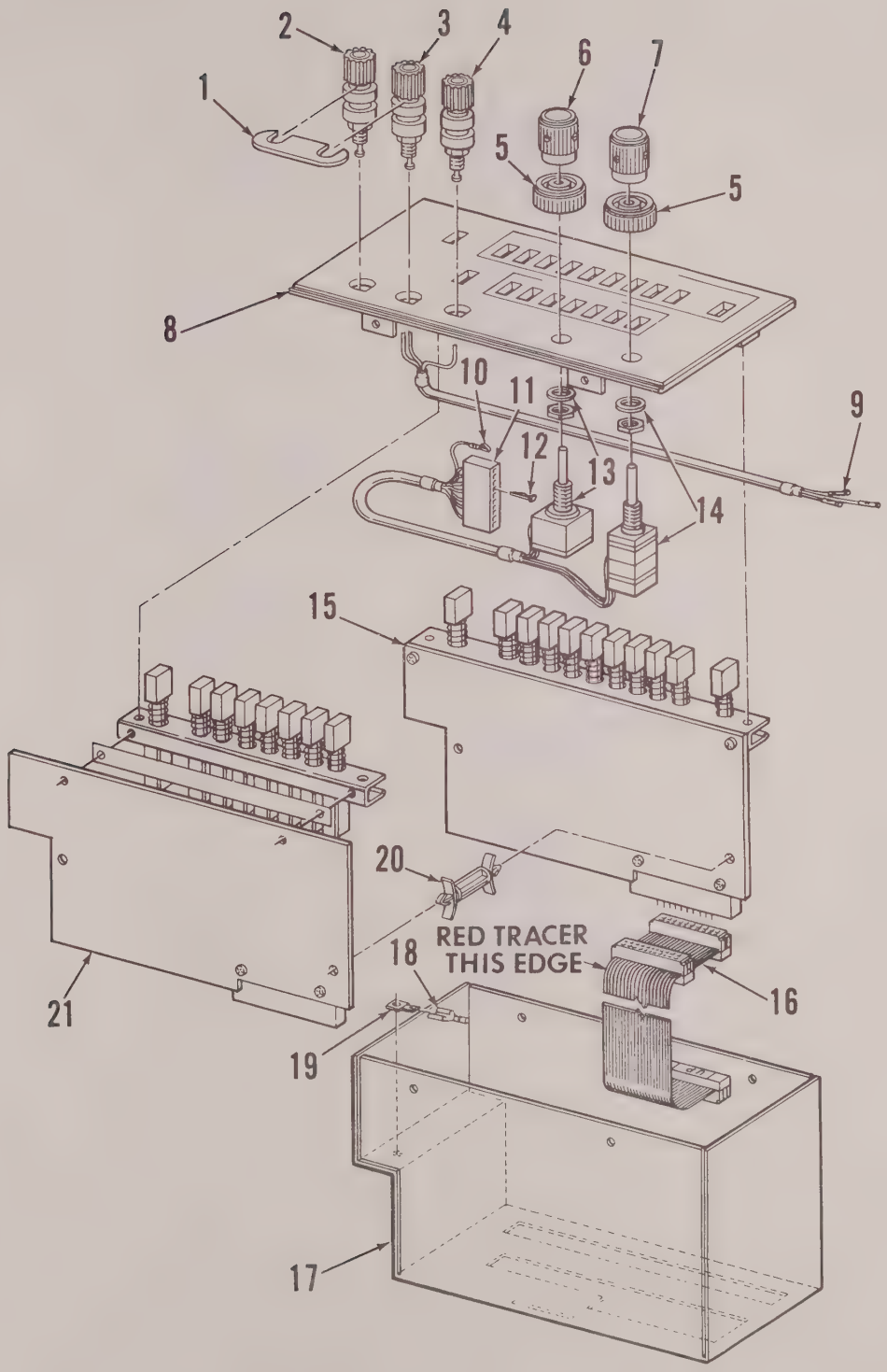


FIGURE 6-18 PREAMP ASSY, 3054, X-AXIS 893226-X

PREAMP BOARD ASSY, 3054
PART NUMBER 893707
FIGURE 6-19

SYMBOL NUMBER	PART NUMBER	DESCRIPTION
C1	5-241145-334	Capacitor 0.33μf
C2	10-294871-154	Capacitor 0.15μf
C3, C4	262585-475	Capacitor 4.7μf
C5	5-241145-103	Capacitor .01μf
J1	1-292529-20	Connector
R1	5-241111-226	Resistor 22M
R2	50-128182-4904	Resistor 4.9 Meg
R4	293941-103	Resistor, Variable 10K
R5	1-290003-25001	Resistor, 25K
R6	293941-103	Resistor, Variable 10K
R7	1-265969-500R0	Resistor 500 ohm
R8	1-265969-50001	Resistor 50K
R9	25-284694-40001	Resistor 40K
R10	293941-102	Resistor, Variable 1K
R11	25-284694-40001	Resistor, 40K
R13	293941-103	Resistor, Variable 10K
R14	1-290003-25001	Resistor 25K
R15	1-265969-20003	Resistor, 2 Meg
S1	293952	Switch, Pushbutton
S2	289111	Switch Slide
TP1-TP4	265763-3	Contact, Elec.
U1	293943-1	I.C. AD517L
U2	291062-2	I.C. TL083
U3	293959-1	Resistor Pack
U4	280863-3	I.C. 741
U5	1-288481	Resistor Pack (English)
U5	1-293278	Resistor Pack (Metric)

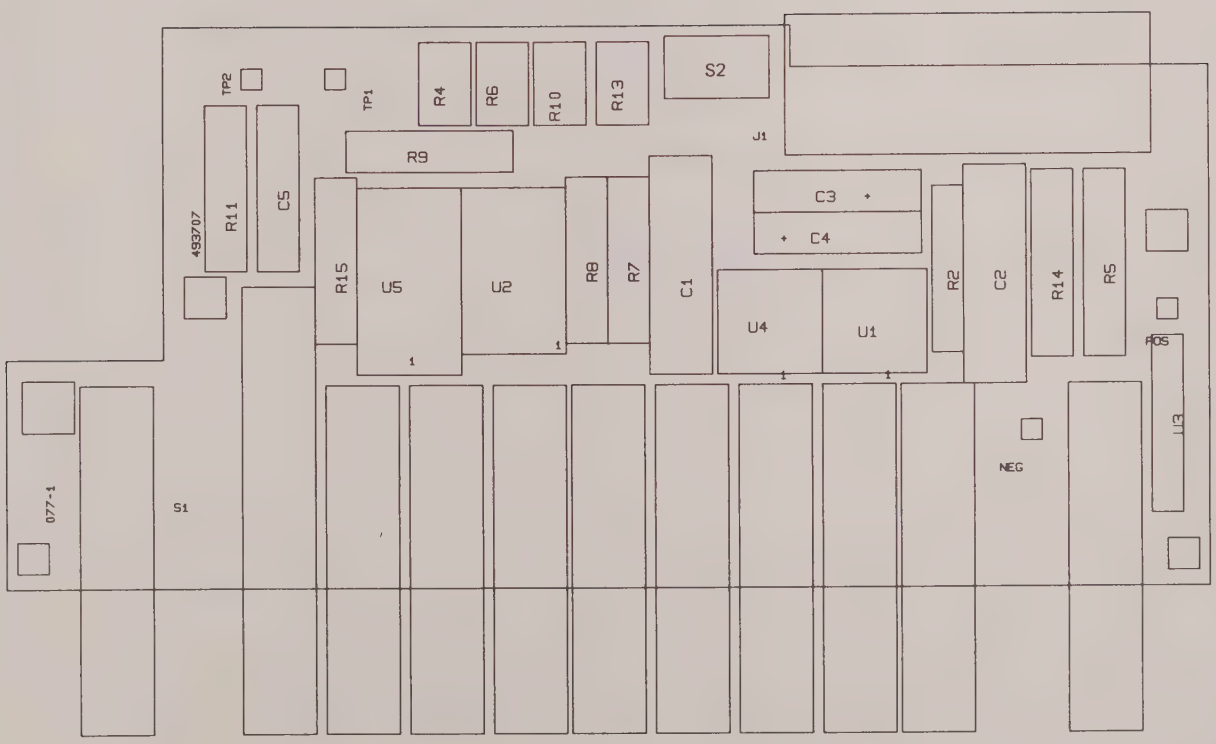


FIGURE 6-19 3054 PREAMP BOARD ASSY 893707

FILTER BOARD ASSY, 3054
PART NUMBER 893708
FIGURE 6-20

SYMBOL NUMBER	PART NUMBER	DESCRIPTION
C1, C2	262585-475	Capacitor 4.7μf
C3,	10-241145-203	Capacitor, .02μf
C4, C5, C6	10-241145-103	Capacitor, .01μf
C7	5-241145-104	Capacitor, .10μf
C8	10-241145-203	Capacitor, .02μf
C9	5-241145-204	Capacitor, .20μf
J1	1-292529-20	Connector
J2	1-287493-10	Connector
R1-R5	RI-284694-10002	Resistor, 100K
R6	25-284694-60000	Resistor, 6K - English Units
R6	25-284694-40000	Resistor, 4K - Metric Units
R7	293941-202	Resistor, Variable 2K
R8	293941-103	Resistor, Variable, 10K
R9	RI-288308-49001	Resistor, 49K
R10	RI-288308-50001	Resistor, 50K
R11	25-265969-30002	Resistor, 300K - English Units
R11	25-265969-47502	Resistor, 475K - Metric Units
R12	293941-503	Resistor, Variable 50K
R13	RI-288308-25001	Resistor, 25K
R14, R15	1-265969-20002	Resistor, 200K
R17	RI-288308-10000	Resistor, 1K
R23	1-265969-30001	Resistor, 30K
S1	293948	Switch, Pushbutton
S1-I	294169	Insulator
TP3-TP6	265763-3	Contact, Elec.
U1	292885	OP Amp LF351BN
U2, U3	289385	OP Amp LF1374IN

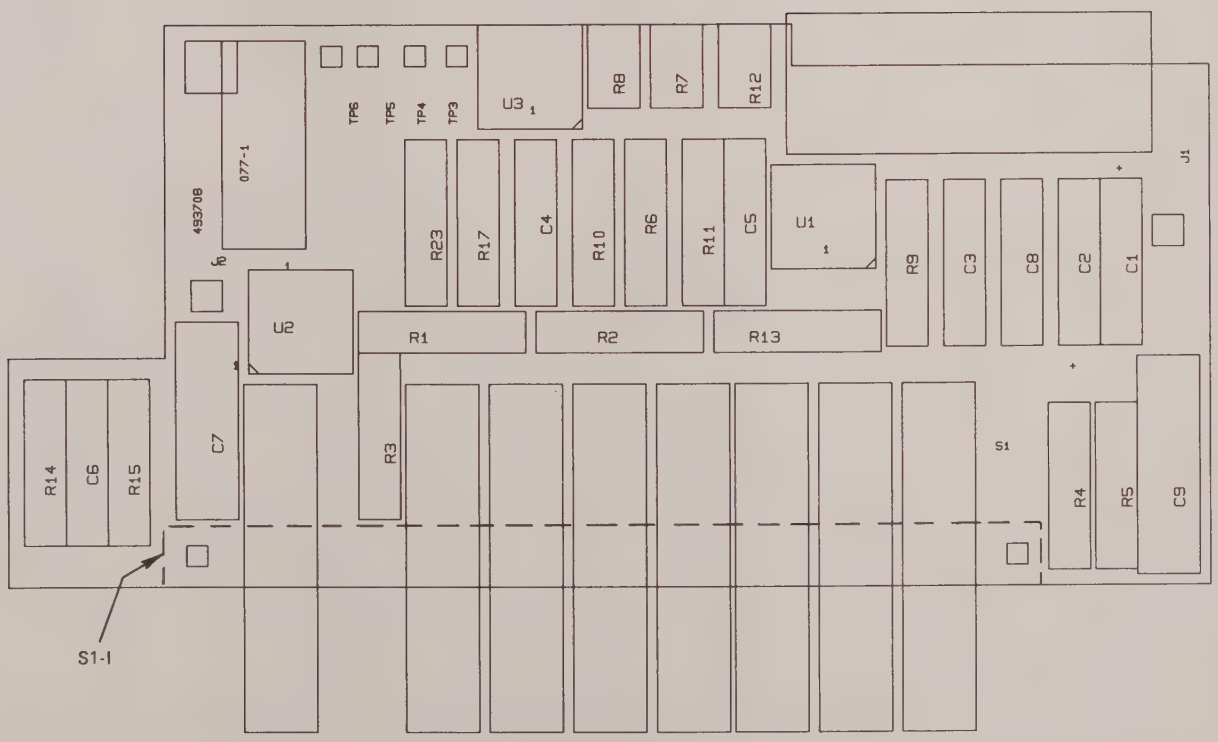


FIGURE 6-20 FILTER BOARD ASSY 893708

MISC. POWER BOARD ASSY*
PART NUMBER 893867
FIGURE 6-21

SYMBOL NUMBER	PART NUMBER	DESCRIPTION
C1	281509-477	Capacitor 500μf
C2	287620-227	Capacitor 220μf
C3	35-281295-228	Capacitor 2200μf
C3S	232997-24	Strap Retaining
C4, C5	282283-9	Capacitor .015μf
C6	262581-503	Capacitor .05μf
C7	282283-9	Capacitor .015μf
CR1	286018-2	Rectifier, Bridge
CR2, CR3	269256-5	Diode IN4005
F1	102625-9	Fuse 1A 3AG
F1-C	285577	Clip, Fuse
J1	281711-2	Connector
J2	281711-4	Connector
J3	281711-8	Connector
J4	281711-6	Connector
J5	281711-3	Connector
J6	281711-15	Connector
J7A	9-282623-15	Connector
J7B	9-282623-4	Connector
J8	281711-8	Connector
J9	281711-7	Connector
K1, K2	293735-1	Relay, Dip
K1A, K2A	293735-3	Relay, Dip (Alternate)
R1, R2	5-241111-103	Resistor 10K
R3	10-119370-750	Resistor 75 ohm
R4, R5	5-115557-102	Resistor 1K
R6-R9	5-115557-106	Resistor 10 Meg
R10-R13	5-115557-474	Resistor 470K
S1	293731	Switch, Pushbutton, DPDT
U1	287609	I.C. 75451
VR1	285317	Regulator MC7805 (LM340-T5)
VR1-H	293324-1	Heatsink
VR1-K	292900	Kit, Insulation
W1	5-120608	Wire #22 GRN
W2	267235	Jumper
X1, X2, X3	265763-3	Contact Elec.
Y1, Y2, Y3	265763-3	Contact Elec.

NOTE: Used only on Analog Time Base Units (shipped thru October, 1981).

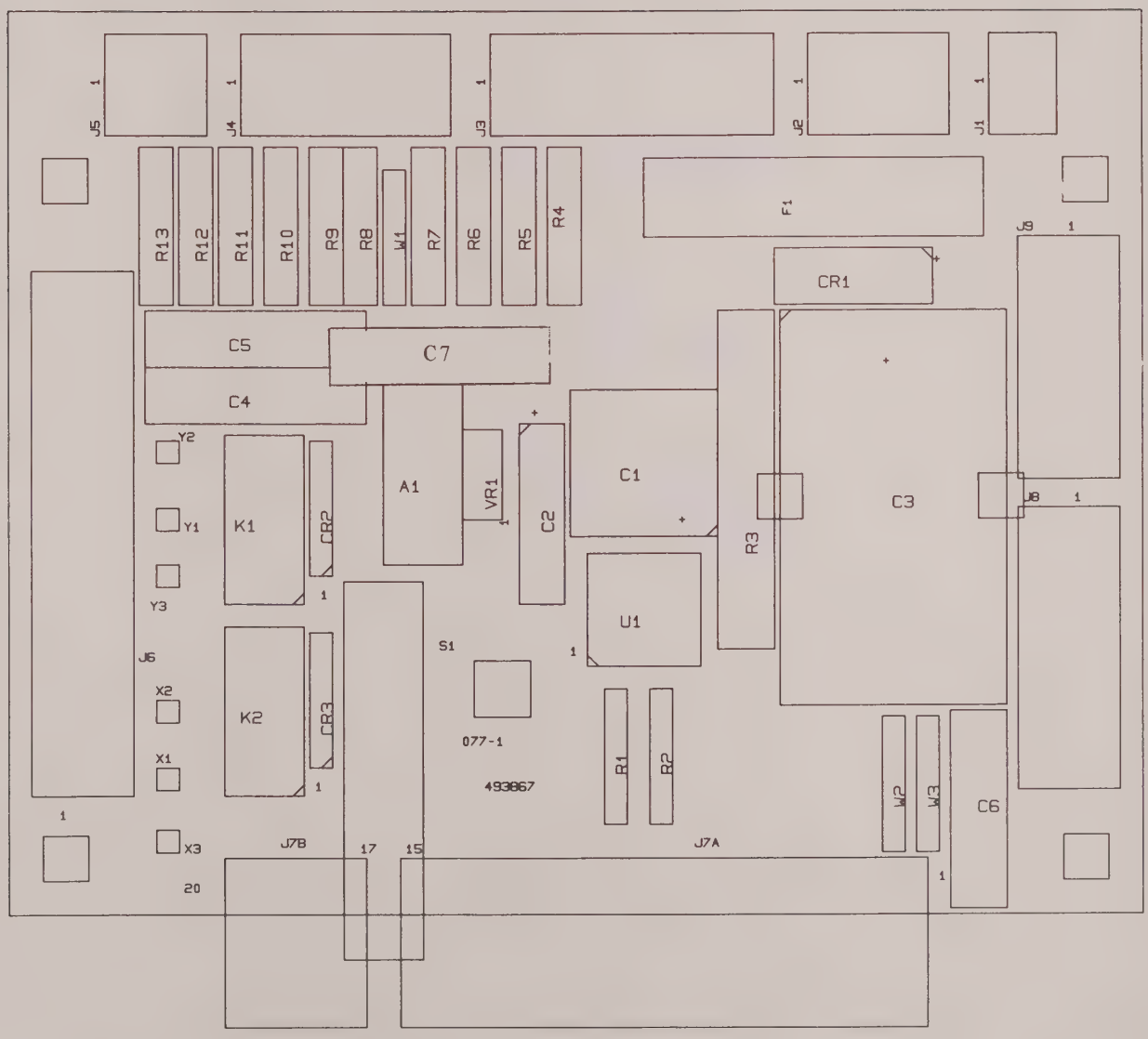


FIGURE 6-21 MISC. POWER BOARD ASSY 893867

PREAMP ASSY, 3052, Y AXIS
PART NUMBER 894924-X
FIGURE 6-22

ITEM NUMBER	PART NUMBER	DESCRIPTION	USED ON
	894924-1	Preamp Assy, Y-Axis (English)	A
	894924-2	Preamp Assy, Y-Axis (Metric)	B
1	294075	Guard, Link	A, B
2	286006-6	Binding, Post	A, B
3	286006-10	Binding Post	A, B
4	286006-2	Binding Post	A, B
5	694245	Knob Assy, Locking (A-P)	A, B
	1-293279-1	Nut	A, B
		-----*-----	
6	285651-16	Knob	A, B
7	285651-3	Knob	A, B
8	793552-2	Panel Assy, Silkscreen (English)	A
	793557-2	Panel Assy, Silkscreen (Metric) (A-P)	B
	31-119918-4006	Screw	A, B
	1-103838-12	Nut	A, B
		-----*-----	
	865693-40	Cable Assy, Input	A, B
9	265760-1	Contact, Elect	A, B
	793916	Harness Assy, Pen Pos/Sen	A, B
10	287490	Contact, Elect	A, B
11	287491-10	Connector	A, B
12	287489	Key, Polarizing	A, B
13	293271-2	Resistor, Variable 50K	A, B
14	293946-503	Resistor, Variable 50K	A, B
15	894005-3	Board Assy, Preamp ® (English)	A
	894005-4	Board Assy, Preamp ® (Metric) (A-P)	B
	13-262716-2604	Screw	A, B
		-----*-----	
16	883878-29	Cable Assy, Flat	A, B
	2-292531-20	Connector	A, B
	282356-3	Label, Up	A, B
17	794936	Shield, Y-Axis Pre-Amp	A, B
18	265840-1	Lug, Terminal	A, B
19	270270-2	Lug (A-P)	A, B
	230822-40	Nut, Lock	A, B
	5-120053-101	Lockwasher (place between items 17 & 19)	A, B
	31-119914-4004	Screw, Mach.	A, B
		-----*-----	

® See Figure 6-24

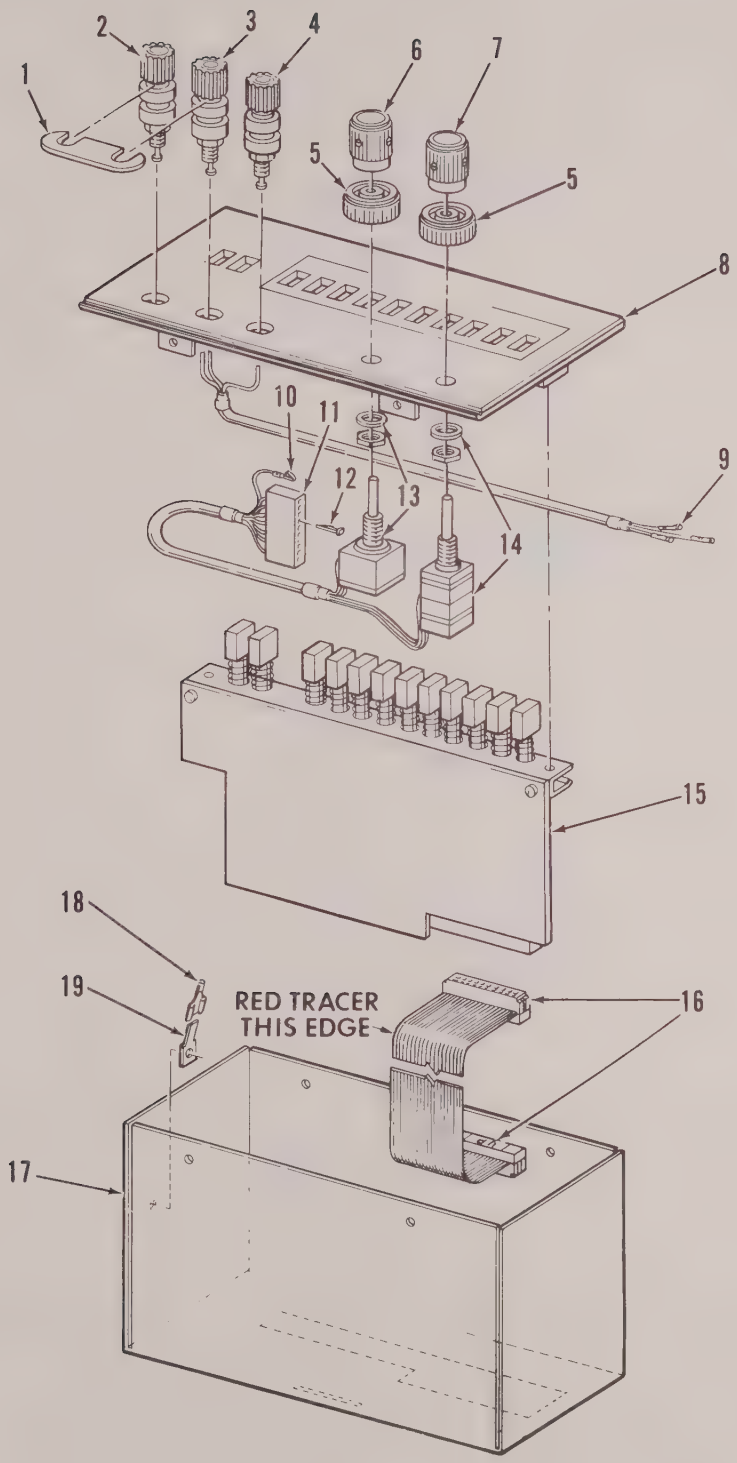


FIGURE 6-22 PREAMP ASSY, 3052, Y AXIS 894924-X

PREAMP ASSY 3052, X AXIS
PART NUMBER 894923-X
FIGURE 6-23

ITEM NUMBER	PART NUMBER	DESCRIPTION	USED ON
	894923-1	Pre Amp Assy X-Axis (English)	A
	894923-2	Preamp Assy X-Axis (Metric)	B
1	294075	Guard, Link	A, B
2	286006-6	Binding Post	A, B
3	286006-10	Binding Post	A, B
4	286006-2	Binding Post	A, B
5	694245	Knob Assy, Locking (A-P)	A, B
	1-293279-1	Nut	A, B
		-----*-----	
6	285651-16	Knob	A, B
7	285651-3	Knob	A, B
8	793552-1	Panel Assy, Silkscreen (English)	A
	793557-1	Panel Assy, Silkscreen (Metric) (A-P)	B
	31-119918-4006	Screen	A, B
	1-103838-12	Nut	A, B
		-----*-----	
	865693-40	Cable Assy, Input	A, B
9	265760-1	Contact, Electrical	A, B
	793916	Harness Assy, Pen Pos/Sen.	A, B
10	287490	Contact, Electrical	A, B
11	287491-10	Connector	A, B
12	287489	Key, Polarizing	A, B
13	293271-2	Resistor, Variable 50K	A, B
14	293946-503	Resistor, Variable 50K	A, B
15	894005-1	Board Assy, Preamp ⊛ (English)	A
	894005-2	Board Assy, Preamp ⊛ (Metric) (A-P)	B
	13-262716-2604	Screw	A, B
		-----*-----	
16	883878-29	Cable Assy, Flat	A, B
	2-292531-20	Connector	A, B
	2-282356-3	Label, Up	A, B
17	794935	Shield, X-Axis Pre-Amp	A, B
18	265840-1	Lug, Terminal	A, B
19	270270-2	Lug (A-P)	A, B
	230822-40	Nut, Lock	A, B
	5-120053-101	Lockwasher (place between items 17 & 19)	A, B
	31-119914-4004	Screw, Mach.	A, B
		-----*-----	

⊛ See Figure 6-24

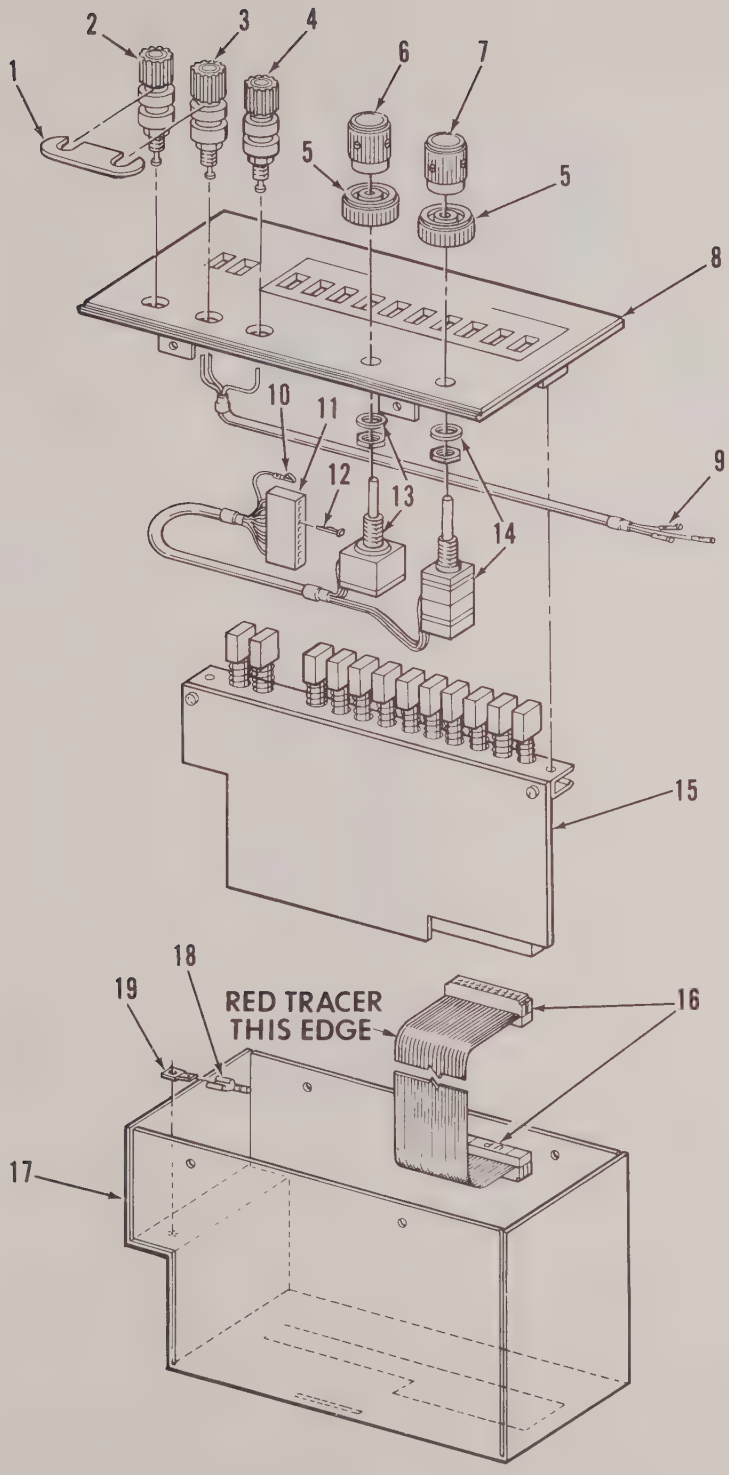


FIGURE 6-23 PREAMP ASSY, 3052, X AXIS 894923-X

PREAMP BOARD ASSY, 3052
PART NUMBER 894005-X
FIGURE 6-24

SYMBOL NUMBER	PART NUMBER	DESCRIPTION	USED ON
	894005-1	Preamp Board Assy, X Axis (English)	A
	894005-2	Preamp Board Assy, X Axis (Metric)	B
	894005-3	Preamp Board Assy, Y Axis (English)	C
	894005-4	Preamp Board Assy, Y Axis (Metric)	D
C1	5-241145-334	Capacitor, 0.33μf	A, B, C, D
C2	10-294871-154	Capacitor, 0.15μf	A, B, C, D
C3, C4	262585-475	Capacitor, 4.7μf	A, B, C, D
C5	5-241145-204	Capacitor, 0.2μf	A, B, C, D
C6	10-241145-203	Capacitor, 0.02μf	A, B, C, D
C7	5-241145-104	Capacitor, 0.1μf	A, B, C, D
C8, C9	10-241145-103	Capacitor, 0.01μf	A, B, C, D
J1	1-292529-20	Connector	A, B, C, D
J2	1-287493-10	Connector	A, B, C, D
R1, R2	1-290003-25001	Resistor, 25K	A, B, C, D
R3	1-265969-500R0	Resistor, 500 ohm	A, B, C, D
R4	1-265969-50001	Resistor, 50K	A, B, C, D
R5	RI-288308-50001	Resistor, 50K	A, B, C, D
R6	1-265969-30001	Resistor, 30K	A, B, C, D
R7, R8	1-265969-20002	Resistor, 200K	A, B, C, D
R9	5-241111-226	Resistor, 22 Meg	A, B, C, D
R10	293941-503	Resistor, Variable, 50K	A, B, C, D
R11	25-265969-30002	Resistor, 300K	A, B
R11	25-265969-47502	Resistor, 475K	C, D
R12	293941-103	Resistor, Variable, 10K	A, B, C, D
R13	1-265969-20003	Resistor, 2 Meg	A, B, C, D
S1	294787	Switch, Pushbutton	A, B, C, D
TP1-TP4, +, −	265763-3	Contact, Elect.	A, B, C, D
U1	293943-1	I.C., AD517L	A, B, C, D
U2	291062-3	I.C., TL084	A, B, C, D
U3	293959-1	Resistor Pack	A, B, C, D
U4	1-288481	Resistor Pack	A, C
U4	1-293278	Resistor Pack	B, D

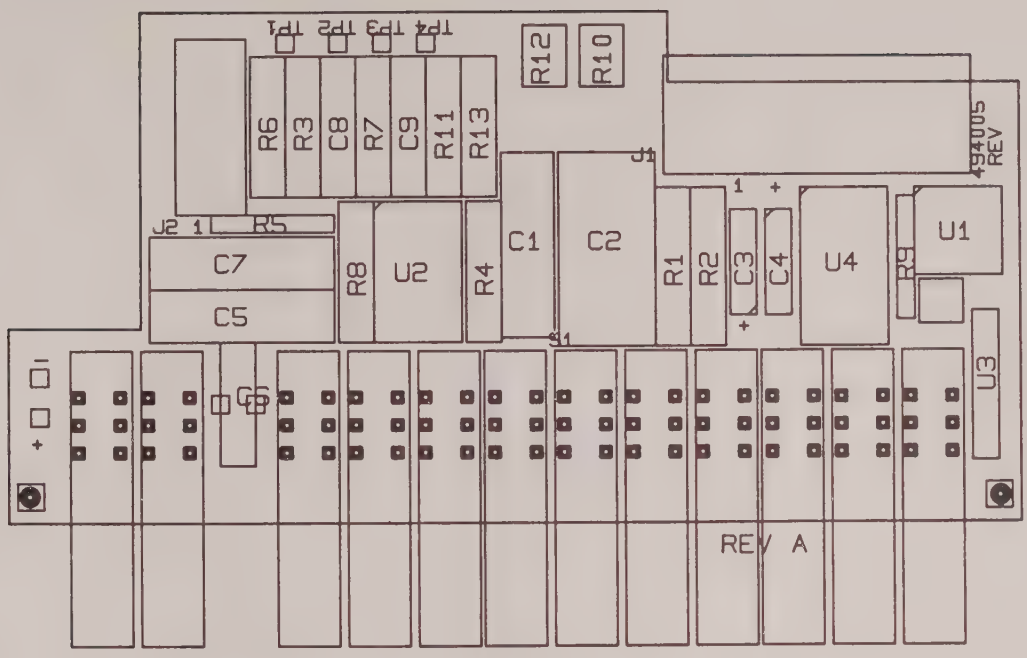


FIGURE 6-24 3052 PREAMP BOARD ASSY 894005

MISC. POWER BOARD ASSY.
PART NUMBER 894550
FIGURE 6-25

SYMBOL NUMBER	PART NUMBER	DESCRIPTION
C1	294991-228	Capacitor, 2200 μf
C2	294993-227	Capacitor, 220 μf
C3	35-281295-228	Capacitor, 220- μf
C4, C5	282283-9	Capacitor, .015 μf
C6	262581-503	Capacitor, .05 μf
C7	282283-9	Capacitor, .015 μf
C8	10-294871-154	Capacitor
CR1	286018-2	Rectifier, Bridge
CR2, CR3	269256-5	Diode 1N4005
F1	102625-9	Fuse 3A 3AG
F1-clip	285577	Clip, Fuse
J1	281711-2	Connector
J2	281711-4	Connector
J3	281711-8	Connector
J4	281711-6	Connector
J5	281711-3	Connector
J6	281711-15	Connector
J7	1-292529-20	Connector
J8	281711-8	Connector
K1, K2	293735-1	Relay, DIP (see next item)
K1, K2	293753-5	Relay, DIP (alternate for above)
Q1	281702-2	Transistor 2N4401
Q2	282934-1	Transistor MJE800
R1, R2	5-241111-103	Resistor, 10K
R3	10-119370-300	Resistor, 30 ohms
R4, R5	5-115557-102	Resistor, 1K
R6 thru R9	5-115557-106	Resistor, 10 Megohms
R10 thru R13	5-115557-474	Resistor, 470K
R14	5-241111-102	Resistor, 10K
R15, R16	5-241111-823	Resistor
R17, R18	282299-203	Potentiometer
S1	235770-1	Switch, DPDT
VR1	285317	Regulator, MC7805 (LM340-T5)
VR1-HS	293324-1	Heatsink
VR1-IK	292900	Kit, Insulation

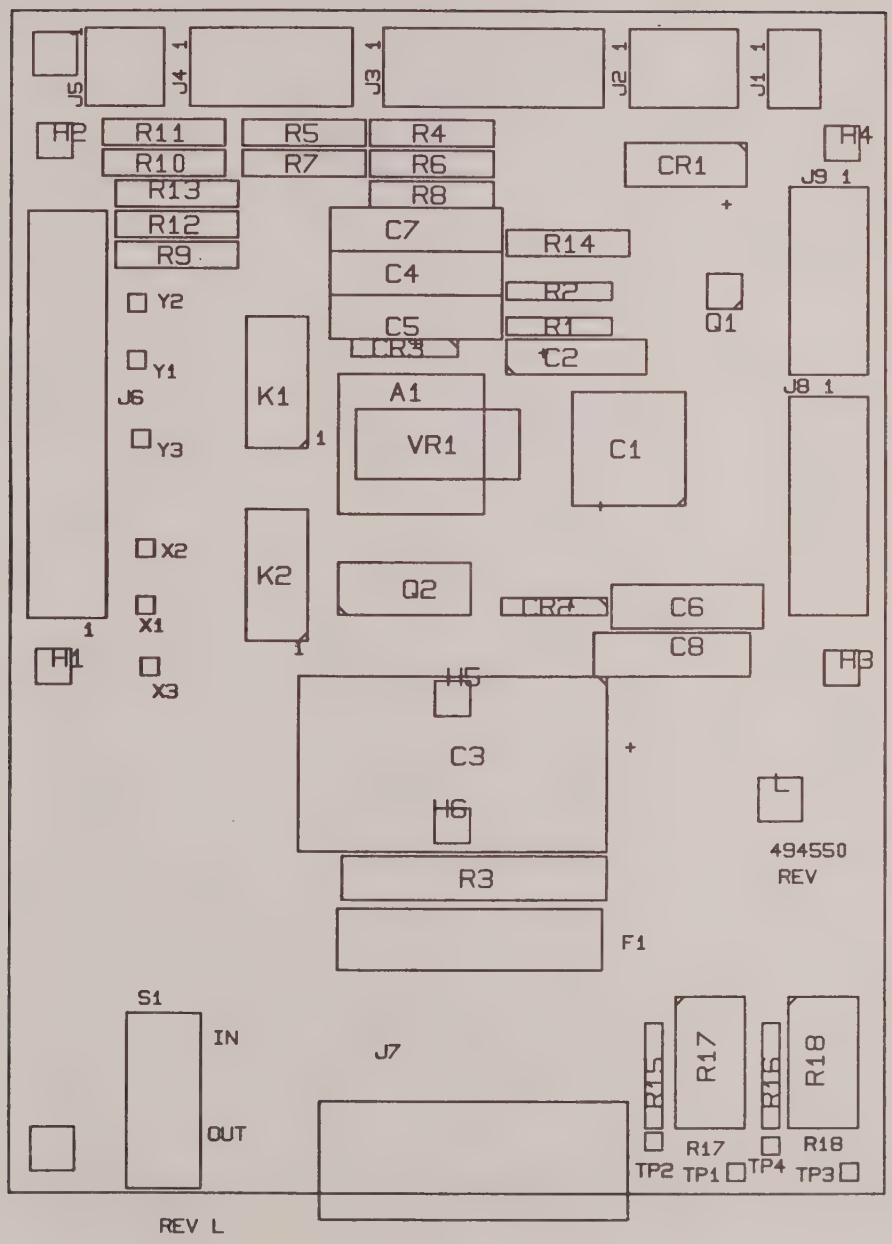


FIGURE 6-25 MISCELLANEOUS POWER BOARD ASSEMBLY 894550

PREAMP ASSY, 3056 Y AXIS
PART NUMBER 894847-X
FIGURE 6-26

ITEM NUMBER	PART NUMBER	DESCRIPTION	USED ON
	894847-1	Preamp Assy, Y-Axis (English)	A
	894847-2	Preamp Assy, Y-Axis (Metric)	B
1	294075	Guard, Link	A, B
2	286006-6	Binding, Post	A, B
3	294862-10	Binding Post	A, B
4	294862-2	Binding Post	A, B
5	694245	Knob Assy, Locking (A-P)	A, B
	1-293279-1	Nut	A, B
		-----*-----	
6	285651-16	Knob	A, B
7	285651-3	Knob	A, B
8	794851-2	Panel Assy, Silkscreen (English)	A
	794850-2	Panel Assy, Silkscreen (Metric) (A-P)	B
	31-119918-4006	Screw	A, B
	1-103838-12	Nut	A, B
		-----*-----	
	865693-44	Cable Assy, Input	A, B
9	265760-1	Contact, Elect	A, B
	793916	Harness Assy, Pen Pos/Sen	A, B
10	287490	Contact, Elect	A, B
11	287491-10	Connector	A, B
12	287489	Key, Polarizing	A, B
13	293271-2	Resistor, Variable 50K	A, B
14	293946-503	Resistor, Variable 50K	A, B
15	894770-1	Board Assy, Preamp ® (English)	A
	894770-2	Board Assy, Preamp ® (Metric) (A-P)	B
	13-262716-2604	Screw	A, B
		-----*-----	
16	883878-29	Cable Assy, Flat	A, B
	2-292531-20	Connector	A, B
	282356-3	Label, Up	A, B
17	794760	Shield, Y-Axis Pre-Amp	A, B
18	265840-1	Lug, Terminal	A, B
19	270270-2	Lug (A-P)	A, B
	230822-40	Nut, Lock	A, B
	5-120053-101	Lockwasher (place between items 17 & 19)	A, B
	31-119914-4004	Screw, Mach.	A, B
		-----*-----	
20	1-293955-1	Spacer, P.C.	A, B
21	894771-2	Board Assy, Filter (See Fig. 6-29)	A, B
22	295185	Guard, Preamp	A, B

® See Figure 6-28

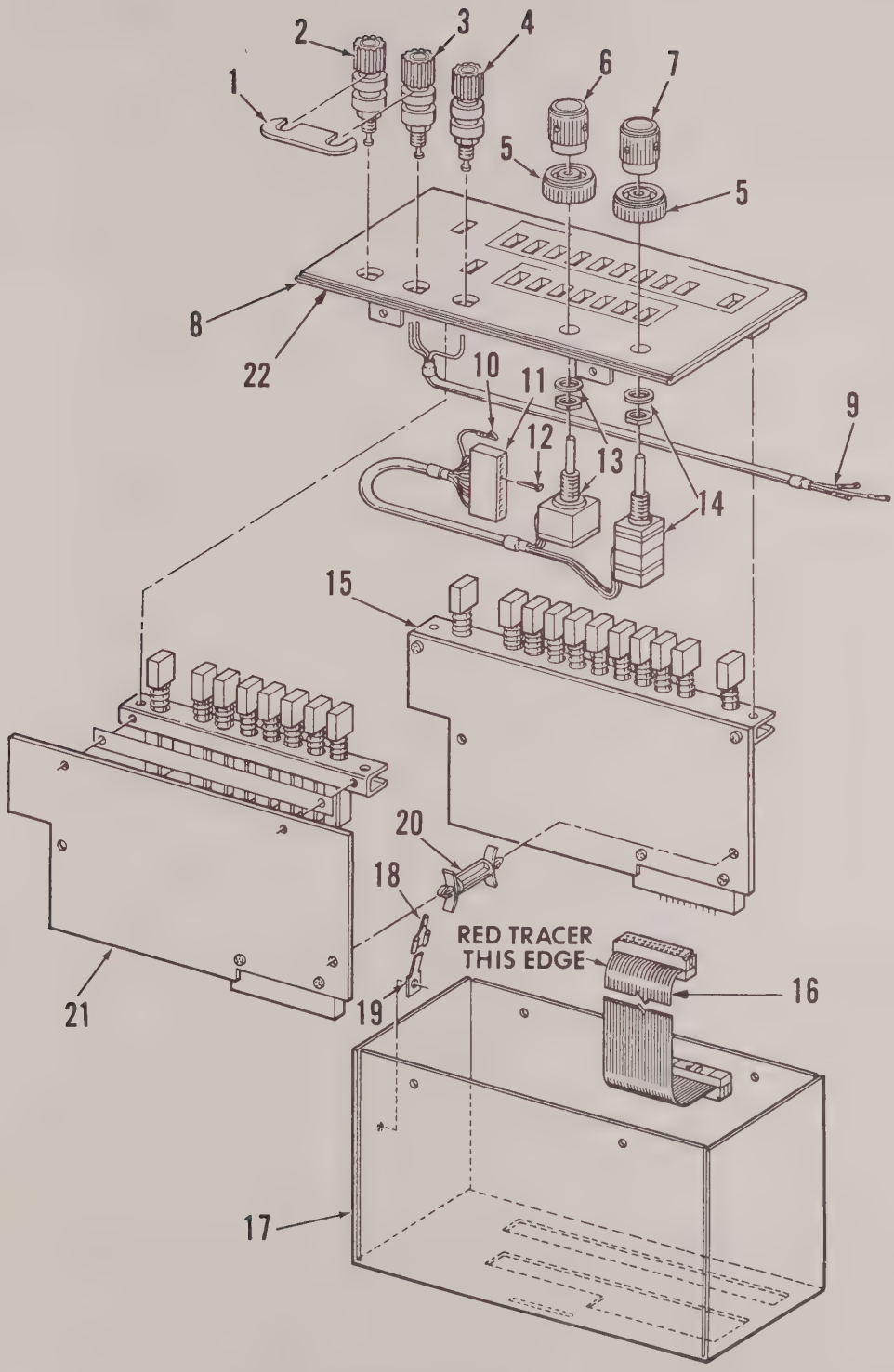


FIGURE 6-26 PREAMP ASSY, 3056, Y-AXIS 894847-X

PREAMP ASSY, 3056 X AXIS
PART NUMBER 894846-X
FIGURE 6-27

ITEM NUMBER	PART NUMBER	DESCRIPTION	USED ON
	894846-1	Pre Amp Assy X-Axis (English)	A
	894846-2	Preamp Assy X-Axis (Metric)	B
1	294075	Guard, Link	A, B
2	286006-6	Binding Post	A, B
3	294862-10	Binding Post	A, B
4	294862-2	Binding Post	A, B
5	694245	Knob Assy, Locking (A-P)	A, B
	1-293279-1	Nut	A, B
		-----*-----	
6	285651-16	Knob	A, B
7	285651-3	Knob	A, B
8	794851-1	Panel Assy, Silkscreen (English)	A
	794850-1	Panel Assy, Silkscreen (Metric) (A-P)	B
	31-119918-4006	Screw	A, B
	1-103838-12	Nut	A, B
		-----*-----	
	865693-44	Cable Assy, Input	A, B
9	265760-1	Contact, Electrical	A, B
	793916	Harness Assy, Pen Pos/Sen.	A, B
10	287490	Contact, Electrical	A, B
11	287491-10	Connector	A, B
12	287489	Key, Polarizing	A, B
13	293271-2	Resistor, Variable 50K	A, B
14	293946-503	Resistor, Variable 50K	A, B
15	894770-1	Board Assy, Preamp ® (English)	A
	894770-2	Board Assy, Preamp ® (Metric) (A-P)	B
	13-262716-2604	Screw	A, B
		-----*-----	
16	883878-29	Cable Assy, Flat	A, B
	2-292531-20	Connector	A, B
	2-282356-3	Label, Up	A, B
17	794760	Shield, X-Axis Pre-Amp	A, B
18	265840-1	Lug, Terminal	
19	270270-2	Lug (A-P)	A, B
	230822-40	Nut, Lock	A, B
	5-120053-101	Lockwasher (place between items 17 & 19)	A, B
	31-119914-4004	Screw, Mach.	A, B
		-----*-----	
20	1-293955-1	Spacer, P.C.	A, B
21	894771-1	Board Assy, Filter (See Fig. 6-29)	A, B
22	295185	Guard, Preamp	A, B

® See Figure 6-28

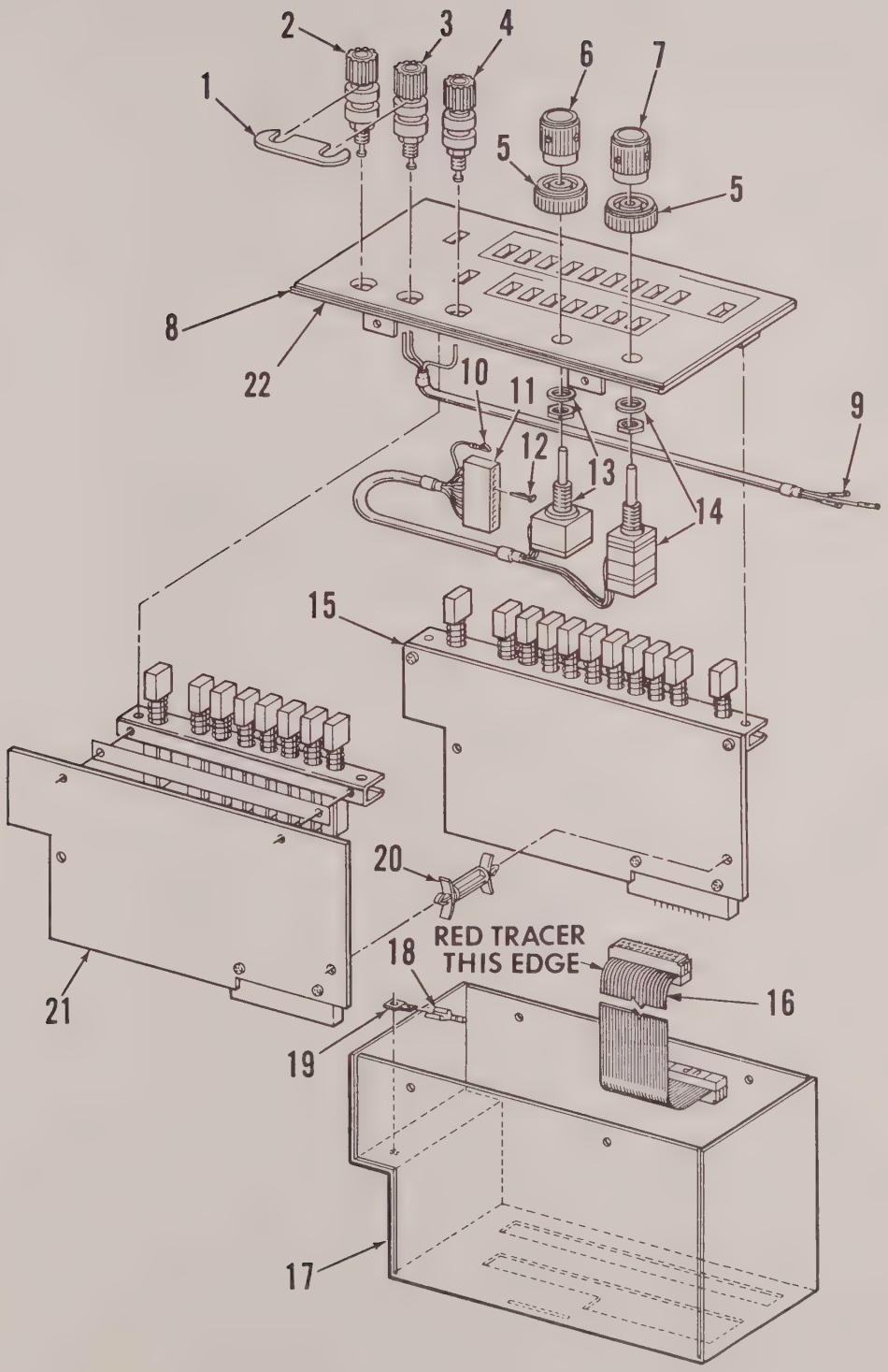


FIGURE 6-27 PREAMP ASSY, 3056 X AXIS 894846-X

PREAMP BOARD ASSY, 3056
PART NUMBER 894770-X
FIGURE 6-28

SYMBOL NUMBER	PART NUMBER	DESCRIPTION
C1	293572-473	Capacitor
C2	293573-563	Capacitor
C3	293572-333	Capacitor
C4	293572-104	Capacitor
C5	293572-224	Capacitor
C6	290303-474	Capacitor
CR1 thru CR4	288072	Diode
J4	294867-1	Jumper, Flexible
R1	293959-1	Resistor Pack
R2	268940-102	Resistor, Variable
R3	268940-103	Resistor, Variable
R4, R5	5-285473-70000	Resistor
R6	25-288308-10000	Resistor
R7	25-288308-121R0	Resistor
R8	1-265969-20003	Resistor
S1	294791	Switch, Pushbutton (A-P)
	31-119918-2604	Screw
	230822-26	Nut Hex, Self-Locking
	243104-2	Washer, Nylon
	294169-1	Insulator
		-----*-----
U1	294874	Amplifier CMOS

FILTER BOARD ASSY, 3056
PART NUMBER 894771-X
FIGURE 6-29

SYMBOL NUMBER	PART NUMBER	DESCRIPTION
C1	10-281282-105	Capacitor
C2	10-281282-504	Capacitor
C3, C4	5-241145-103	Capacitor
C5, C6	10-263695-156	Capacitor
C7, C8	288755-104	Capacitor
J1	1-292529-20	Connector (A-P)
	31-119918-2606	Screw
	31-119998-26	Nut, Hex
		——————*——————
J1-KEY	293337	Key, Polarization
J2	1-287493-10	Connector
J3	285593-20	Connector
R1, R2	25-288308-45001	Resistor
R3, R4	25-288308-15001	Resistor
R5	25-288308-90001	Resistor
R6	25-288308-45001	Resistor
R7	25-288308-50001	Resistor
R8	25-288308-47502	Resistor
R9	268940-503	Resistor, Variable
R10, R11	268940-103	Resistor, Variable
R12, R13	268940-501	Resistor, Variable
R14 thru R23	R1-288308-10000	Resistor
R24, R25	25-288308-20001	Resistor
R26	268940-102	Resistor, Variable
R27	1-265969-30001	Resistor
R28, R29	25-288308-51000	Resistor
R28, R29	25-288308-11751	Resistor
S1	294792	Switch, Pushbutton (A-P)
	31-119918-2604	Screw
	230822-26	Nut Hex, Self-Locking
		——————*——————
TP1, TP2, TP3, GND	265763-3	Contact, Elect.
U1, U2	290011	I.C.
U3	280863-3	I.C.

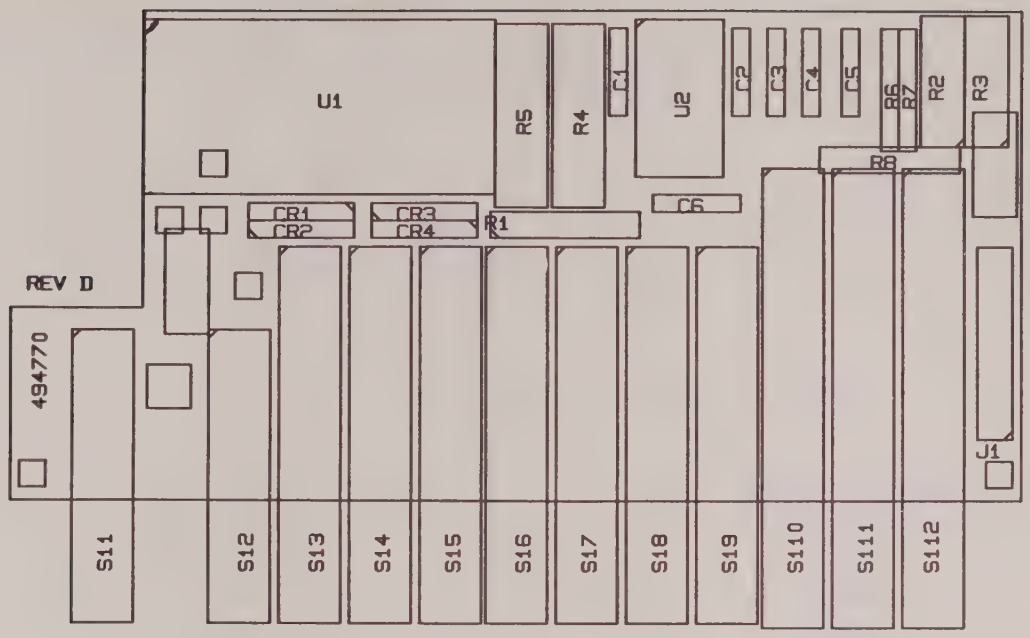


FIGURE 6-28 3056 PREAMP BOARD ASSY 894770

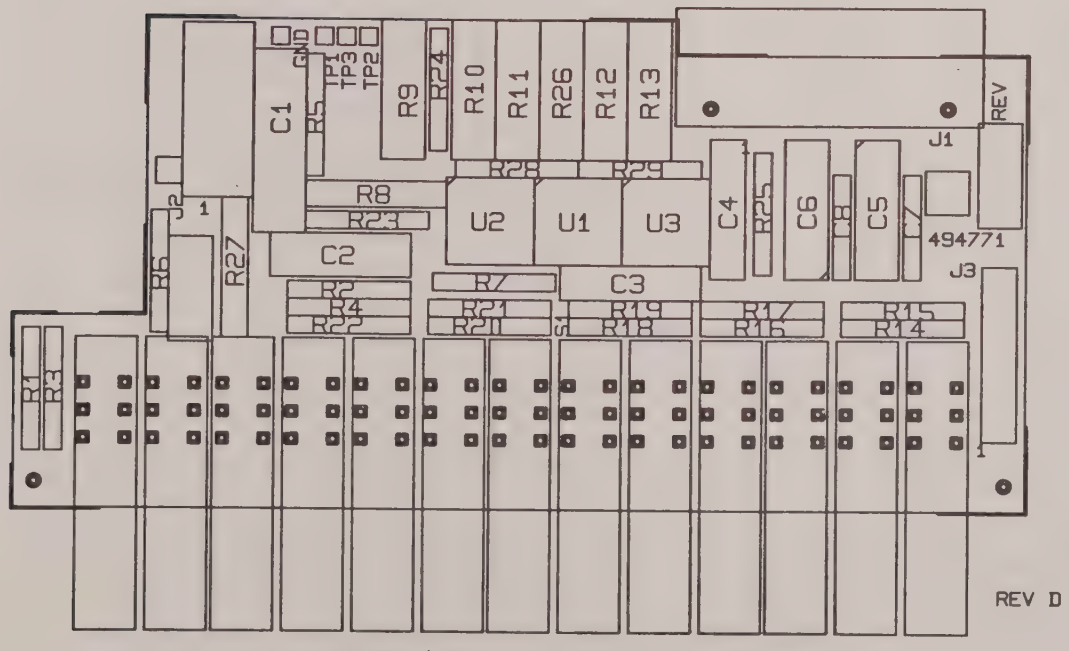


FIGURE 6-29 3056 FILTER BOARD ASSY 894771

APPENDIX
SCHEMATIC DRAWINGS

This section contains complete schematic drawings for the recorder. The schematics are arranged in numerical order by drawing number. All documents included in this section are listed below, in alphanumeric order by title, along with their drawing numbers to help locate them. The part number of any PC board assembly may be obtained by replacing the initial "2" in the schematic number with an "8".

ALPHABETICAL LIST OF SCHEMATICS

Description of Assembly	Schematic Drawing Number
Clock Board**	294433
Control Board*	293873
D/A Board**	294434
Drive Amplifier Board	293230
Filter Board, 3054	293708
Filter Board, 3056	294771
Integrator Board*	293871
Logic Board*	293872
Misc. Power Board*	293867
Misc. Power Board**	294550
Pre-Amp Board, 3052	294005
Pre-Amp Board, 3054	293707
Pre-Amp Board, 3056	294770
Switch Panel Assy	294202
System Schematic, 3052	294818
System Schematic, 3054	294224
System Schematic, 3056	294803
Y-Axis Harness Assembly	293818

*Analog Time Base Units - shipped through October, 1981.
**Digital Time Base Units - shipped after October, 1981.

J-1	NOT AFFECTED DCN 28160/S. JONES	5-[illegible]-81	F-1	REVISED PER DCN 27071/J. COMELLA	10-8-80	C-1	NOT AFFECTE
K-1	NOT AFFECTED DCN 28251/S. JONES	7-1-81	G-1	NOT AFFECTED PER DCN 27886/J. COMELLA	3-24-81	D-1	REVISED PE
L-1	NOT AFFECTED DCN 28257/S. JONES	7-1-81	H-1	NOT AFFECTED PER DCN 28069/COMELLA	4-30-81	E-1	REVISED P
M-1	REV'D. PER DCN 28572/COMELLA	9-11-81					
N-1	REV'D. PER DCN 27454/SJONES	10-16-81					
P-1	NO CHG.						
Q-1							

TABULATED ITEMS

SYMBOL	X-DRIVE (-1)	Y-DRIVE (-2)
CR15	20V-1N4747A	11V-1N962B
CR16	20V-1N4747A	11V-1N962B
R41	470Ω-5%-½ W	1K 5%-½ W
R42	470Ω-5%-½ W	1K 5%-½ W
R1A	26.7K-1%-¼ W	
F1	3A-3AG	1.50 A-3AG
F2	3A-3AG	1.50 A-3AG
R1B		100K-VAR-¼W
C11	0.14Mf-5%	0.22 Mf 5%

PREAMP CONNECTOR J4

- 10v 20
+ 10v 19
POSITION (FINE) 18
10v REF. GND. 17
16
PREAMP 15
14
AUX. IN 13
12
SIG. GND. 11
10
POSITION (COARSE) 9
8
SLIDEWIRE OUT 7
(USED) N./C. 6
SPARE N./C. 5
(USED) N./C. 4
15v COM 3
-15v 2
+15v 1

TIMEBASE CONNECTOR J5

PREAMP/OUT 1
RAMP/AMP 2
SIG. GND. 3
STANDBY 4
KEY 5
SLIDEWIRE OUT 6

+10.000v
-10.000v
SHIELD GND.
15v. GND.
-15v
+15v.
SIG. GND.
+15
+V 20v (11v)
-V -20v (-11v)
Q7 MJE1104
Q8 MJE1093
U-3 AD2702J
VR-1 LM 340T
VR-2 LM7915
C3 15/35v
C4 15/35v
C7 10/20v
C8 10/20v
C9 10/20v
C10 10/20v
C14 10/20
C15 10/20
R41 (SEE TAB)
R42 (SEE TAB)
CR15
CR16
(-2 ONLY) PHASING TRIM
R1 (SEE TAB)
R2 1MEG 5%
C11 SEE TAB
R3 10K-1%
R4 10K-1%
R5 20K
R6 90.9K-1%
R7 100K-1%
R8 63.4K-1%
R9 100K-1%
R39 1MEG-5%
C13 .04 MF
C12 .01
SPAN ADJ.
TP-1
TP-2
TP-3
TP-4
R10 47K-5%
MC 1458 U-1
2:1
1:1
LOW LIMIT ADJ.
R11 2K
R21 1.5K-5%
R22 2K
LIMIT ADJ. (7 X 10")
R13 3.01K-1%
R14 3.01K 1%
R15 1.78K-1%
R16 49.9K-1%
IN4454
HIGH LIMIT ADJ.
R12 2K
-15v
R18 2K
DAMP
C2
CW
J3
5 4 3 2 1
SHIELD
KEY
+10v
WIPE
-10v
SLIDEWIRE CONNECTOR

NOTES:

1. R-1 ADJUSTED PER I.S. FOR PHASING OF "Y" RESPONSE TO MATCH "X" RESPONSE.
2. ALL RESISTORS ¼ W. UNLESS OTHERWISE SPECIFIED.

Form 4.39 6-72

DCN 26572/J.COMELLA 5-23-80	3-2	NOT AFFECTED PER DCN 25944/HAMILTON	2-29-80
DCN 26661/J.COMELLA 6-24-80	3-3	REVISED PER DCN 26182/K.HAMILTON	3-14-80
DCN 26707/J.COMELLA 6-25-80			

REVISIONS		
SYM	DESCRIPTION	DATE
001	REVISED J.COMELLA	1-9-80
A-1	ORIGINAL RELEASE ISSUE LEVEL	

REV.'S CONT.'ED

IN4401
IN4403
EBC

MJE 1103 OR 1093 (HEATSINK ON BACK)
E C B

TOP VIEW
15 V. REGULATORS
LM 7915 — OUT, INPUT+TAB, GND.
LM 7815 / LM 340T15 — OUT, GND.+TAB, INPUT

POWER CONNECTOR
J1
1 KEY
2 A.C. IN (± 20V)
3 X-FORMER CT.
4 A.C. IN (± 20V)
5 SHIELD
6 N/C.

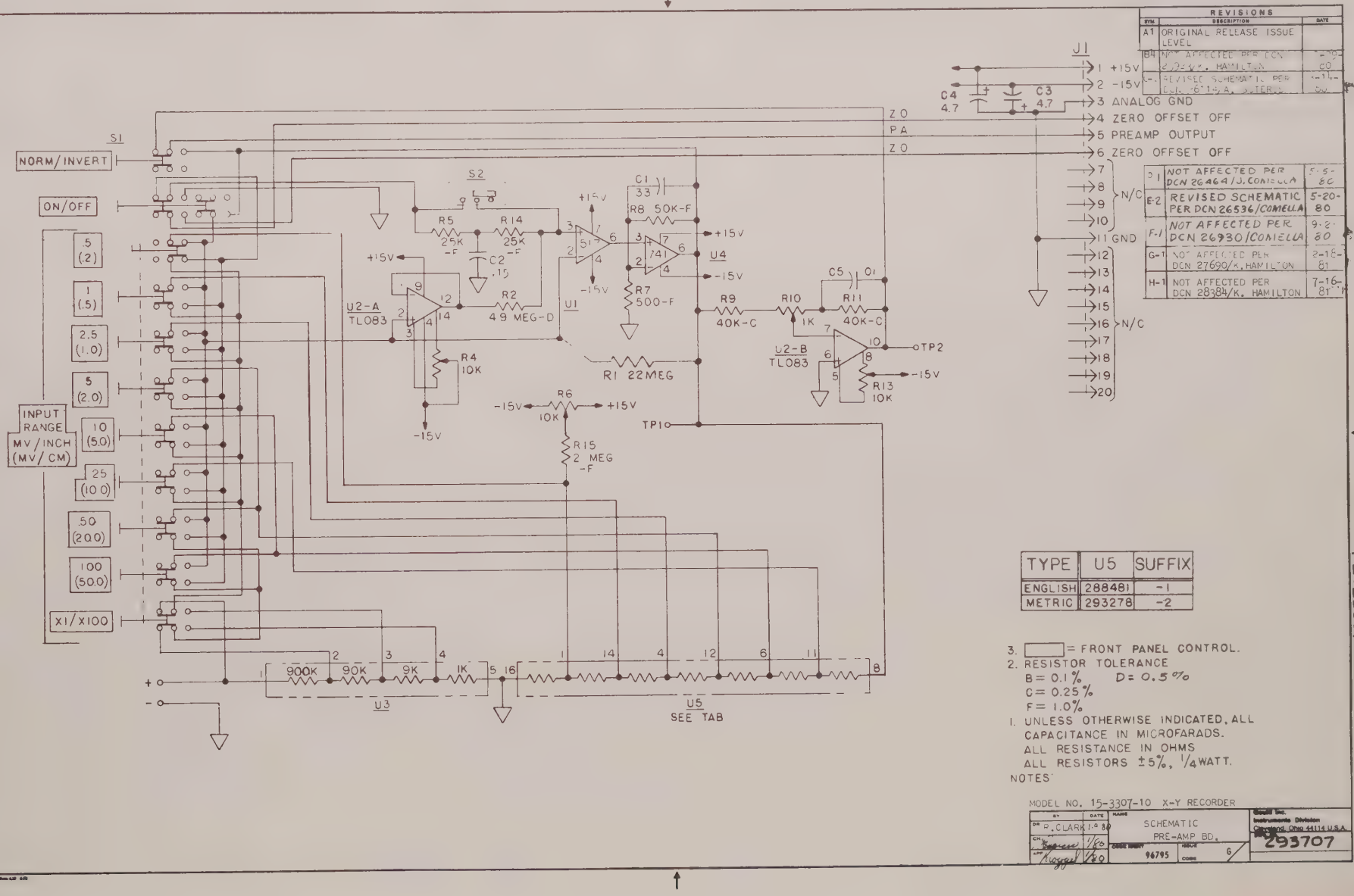
C1 2200/35VDC
C2 2200/35VDC
C5 470/35V
C6 470/35V
CR17 VS248
CR18 VE28
"MECCA GND."
CHASSIS GND. (HEATSINK)

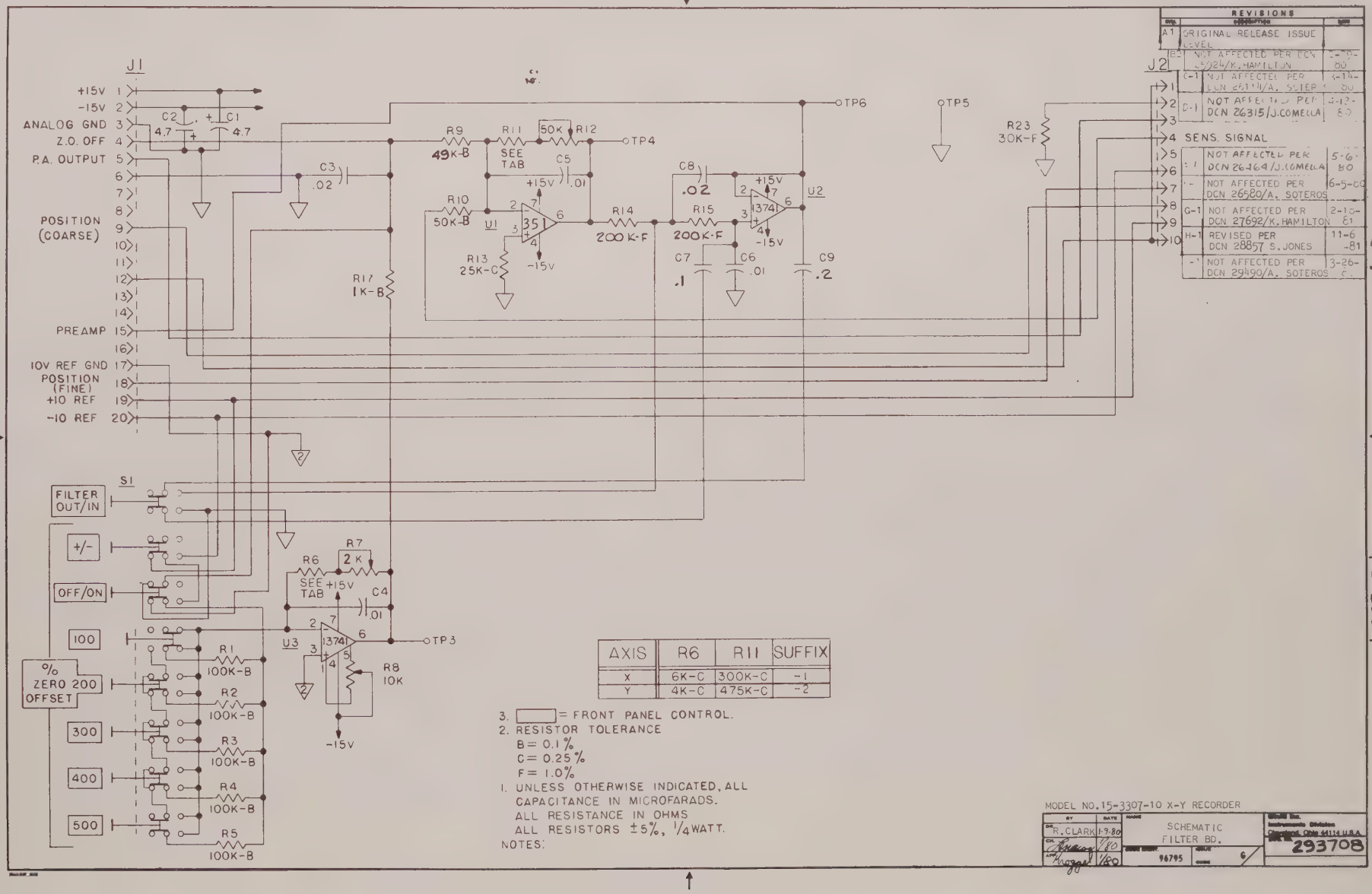
MOTOR CONNECTOR
J2
3 KEY (PIN REMOVED)
2 MOTOR RETURN
1 MOTOR HOT

SERVO GAIN
R24 10K
R23 68K-5%
R27 470K 5%
C26 .015μf MYLAR
R28 68K 5%
C27 .068μf MYLAR
R43 100K 5%
R44 470K
R45 470K
R25 150K-5%
C19 10/20 7.5v
C20 10/20 7.5v
CR9 CR11
CR10 CR12
TP-7
TP-8
+15v
R31 15K-1%
R29 56Ω-5%
Q1 MPS-A14
Q2 MPS-A66
R37 330Ω 5%
R38 330Ω 5%
R30 56Ω-5%
R32 15K 1%
TP-9
TP-10
TP-11
-15v
R34 330Ω-5% 1/2 W
Q3 IN4401
R33 220Ω 5% 1/2 W
Q4 IN4403
R36 330Ω-5% 1/2 W
C16 150pf
R35 2.2K-5% 1/2 W
C18 150 pf
R26 2.2K-5% 1/2 W
MC 1458 U-2
R20 33K-5%
R19 1K-5%
TP-6
TP-5
+V
F2 (SEE TAB)
Q5 MJE 1093
Q6 MJE 1103
-V
F1 (SEE TAB)
C21 30pf
CR13 IN4007
C22 30pf
CR14 IN4007
TP-13
TP-12

15-3307-10 X-Y RECORDER

BY	DATE	NAME	Gould Inc. Instruments Division Cleveland, Ohio 44114 U.S.A.
DR McVey	12-27-79	SCHEMATIC X & Y DRIVE AMP.	
CH		CODE IDENT. 96795	DWG NO. 293230
APP		ISSUE CODE G	


REVISIONS
SYM | DESCRIPTION | DATE
A1 ORIGINAL RELEASE ISSUE LEVEL
B1 NOT AFFECTED PER DCN 26464/J. CONIELLA 5-5-80
E-2 REVISED SCHEMATIC PER DCN 26536/CONIELLA 5-20-80
F-1 NOT AFFECTED PER DCN 26930/CONIELLA 9-2-80
G-1 NOT AFFECTED PER DCN 27690/K. HAMILTON 2-18-81
H-1 NOT AFFECTED PER DCN 28384/K. HAMILTON 7-16-81
J1
1 +15V
2 -15V
3 ANALOG GND
4 ZERO OFFSET OFF
5 PREAMP OUTPUT
6 ZERO OFFSET OFF
7 N/C
8
9
10
11 GND
12
13
14
15
16 N/C
17
18
19
20
C4 4.7
C3 4.7
ZO
PA
ZO
S1
NORM/INVERT
ON/OFF
INPUT RANGE MV/INCH (MV/CM)
.5 (.2)
1 (.5)
2.5 (1.0)
5 (2.0)
10 (5.0)
25 (10.0)
50 (20.0)
100 (50.0)
X1/X100
S2
C1 33
R8 50K-F
+15V
R5 25K -F
R14 25K -F
C2 .15
R2 49 MEG-D
U2-A TL083
U1
R4 10K
R7 500-F
U4
741
R9 40K-C
R10 1K
C5 .01
R11 40K-C
U2-B TL083
TP2
R13 10K
R1 22MEG
R6 10K
R15 2 MEG -F
TP1
900K
90K
9K
1K
U3
U5
SEE TAB
TYPE | U5 | SUFFIX
ENGLISH | 288481 | -1
METRIC | 293278 | -2
3. ☐ = FRONT PANEL CONTROL.
2. RESISTOR TOLERANCE
B = 0.1% D = 0.5%
C = 0.25%
F = 1.0%
1. UNLESS OTHERWISE INDICATED, ALL CAPACITANCE IN MICROFARADS.
ALL RESISTANCE IN OHMS
ALL RESISTORS ±5%, 1/4 WATT.
NOTES:
MODEL NO. 15-3307-10 X-Y RECORDER
DR R. CLARK 1-9-80
CK
APP
SCHEMATIC PRE-AMP BD.
CODE IDENT 96795
ISSUE 6
Gould Inc. Instruments Division Cleveland, Ohio 44114 U.S.A.
293707
293707 | 10



AXIS	R6	R11	SUFFIX
X	6K-C	300K-C	-1
Y	4K-C	475K-C	-2

3. ☐ = FRONT PANEL CONTROL.
2. RESISTOR TOLERANCE
   B = 0.1%
   C = 0.25%
   F = 1.0%
1. UNLESS OTHERWISE INDICATED, ALL CAPACITANCE IN MICROFARADS.
   ALL RESISTANCE IN OHMS
   ALL RESISTORS ±5%, 1/4 WATT.

NOTES:

REVISIONS		
A1	ORIGINAL RELEASE ISSUE LEVEL	
B-1	NOT AFFECTED PER DCN 25024/K. HAMILTON	7-10-80
C-1	NOT AFFECTED PER DCN 26114/A. SOTER	5-14-80
D-1	NOT AFFECTED PER DCN 26315/J. COMELLA	6-12-80
E-1	NOT AFFECTED PER DCN 26464/J. COMELLA	5-6-80
F-1	NOT AFFECTED PER DCN 26580/A. SOTEROS	6-5-80
G-1	NOT AFFECTED PER DCN 27692/K. HAMILTON	2-10-81
H-1	REVISED PER DCN 28857 S. JONES	11-6-81
J-1	NOT AFFECTED PER DCN 29490/A. SOTEROS	3-26-82

MODEL NO. 15-3307-10 X-Y RECORDER

	BY	DATE
DR.	R. CLARK	1-9-80
CH.		1/80
APP.		1/80

SCHEMATIC FILTER BD.

SIZE 96795 GROUP 6

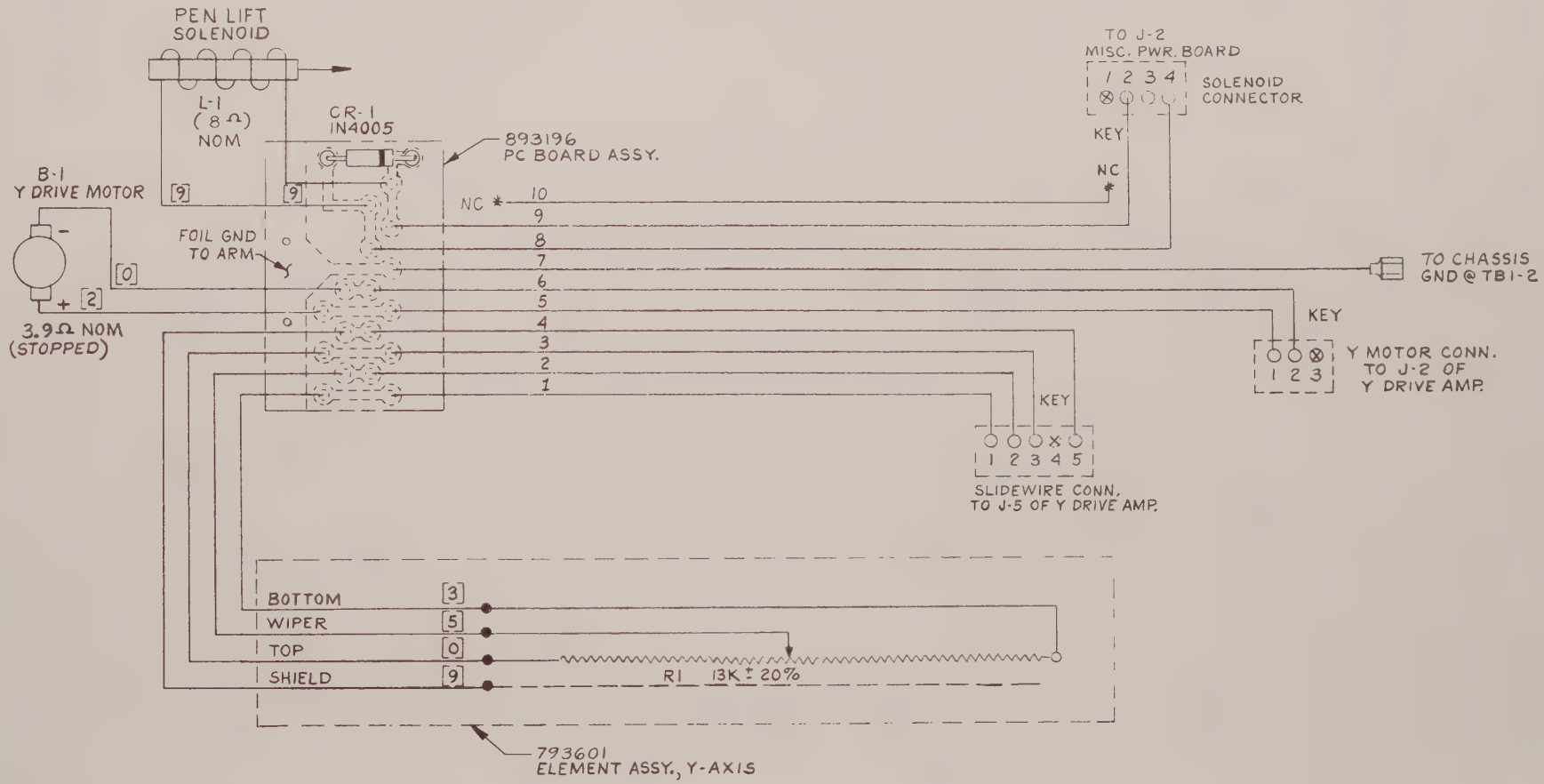
Gould Inc. Instruments Division Cleveland, Ohio 44114 U.S.A.

DR. 293708

293708

82
81

REVISIONS			
SYM	DESCRIPTION	DATE
A-1	8Ω WAS 32Ω PER DCN 26352/J.COMELLA	4-22-80



15-3307-10 X-Y RECORDER

BY	DATE	NAME
DR J.COMELLA	1-9-80	SCHEMATIC Y-AXIS HARNESS ASSY.
CH	1/80	
APP	1-80	

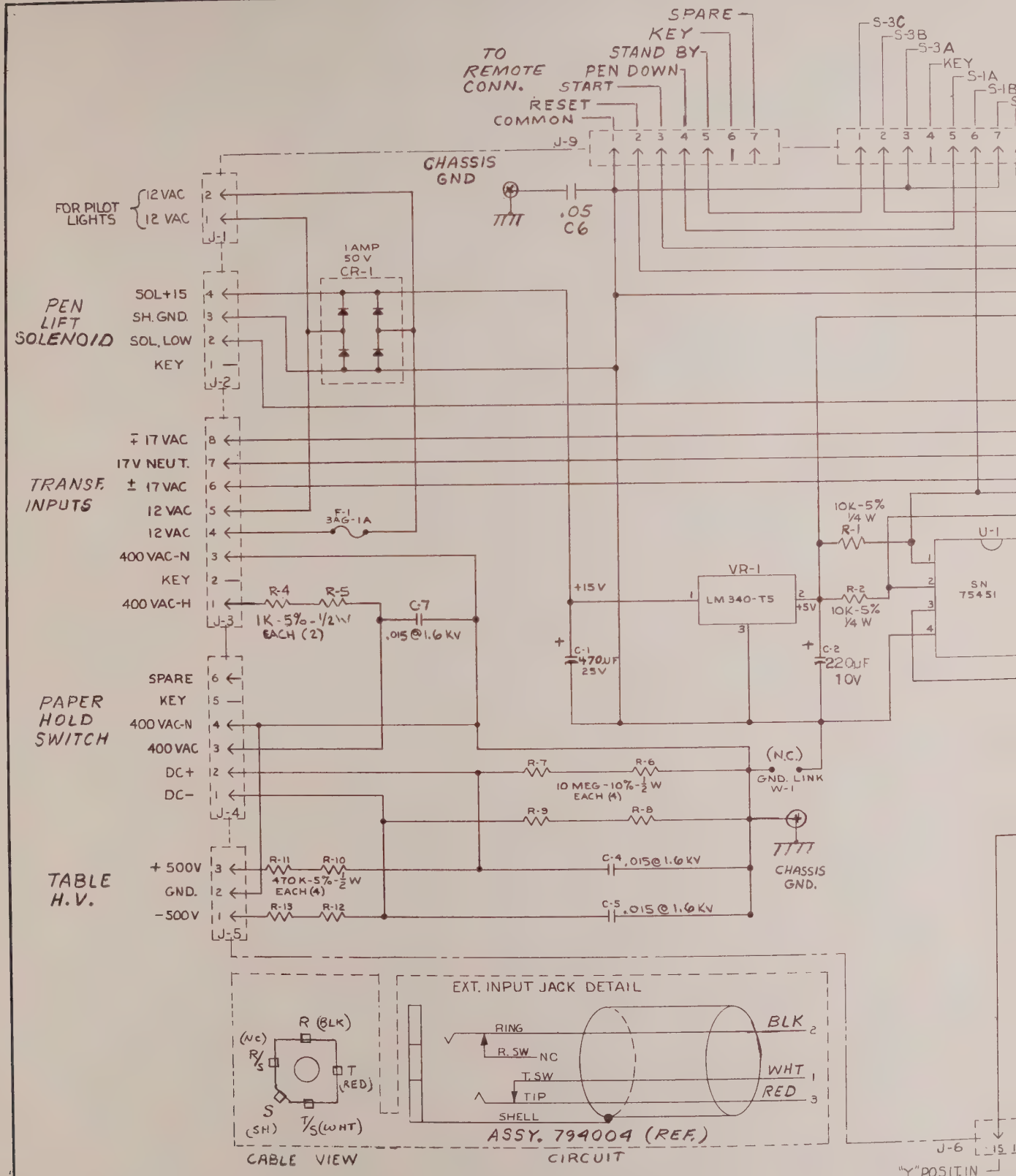
CODE IDENT 96795 | ISSUE CODE 6

Gould Inc. Instrument Systems Division Cleveland, Ohio 44114 U.S.A.

SIZE 293818

181621

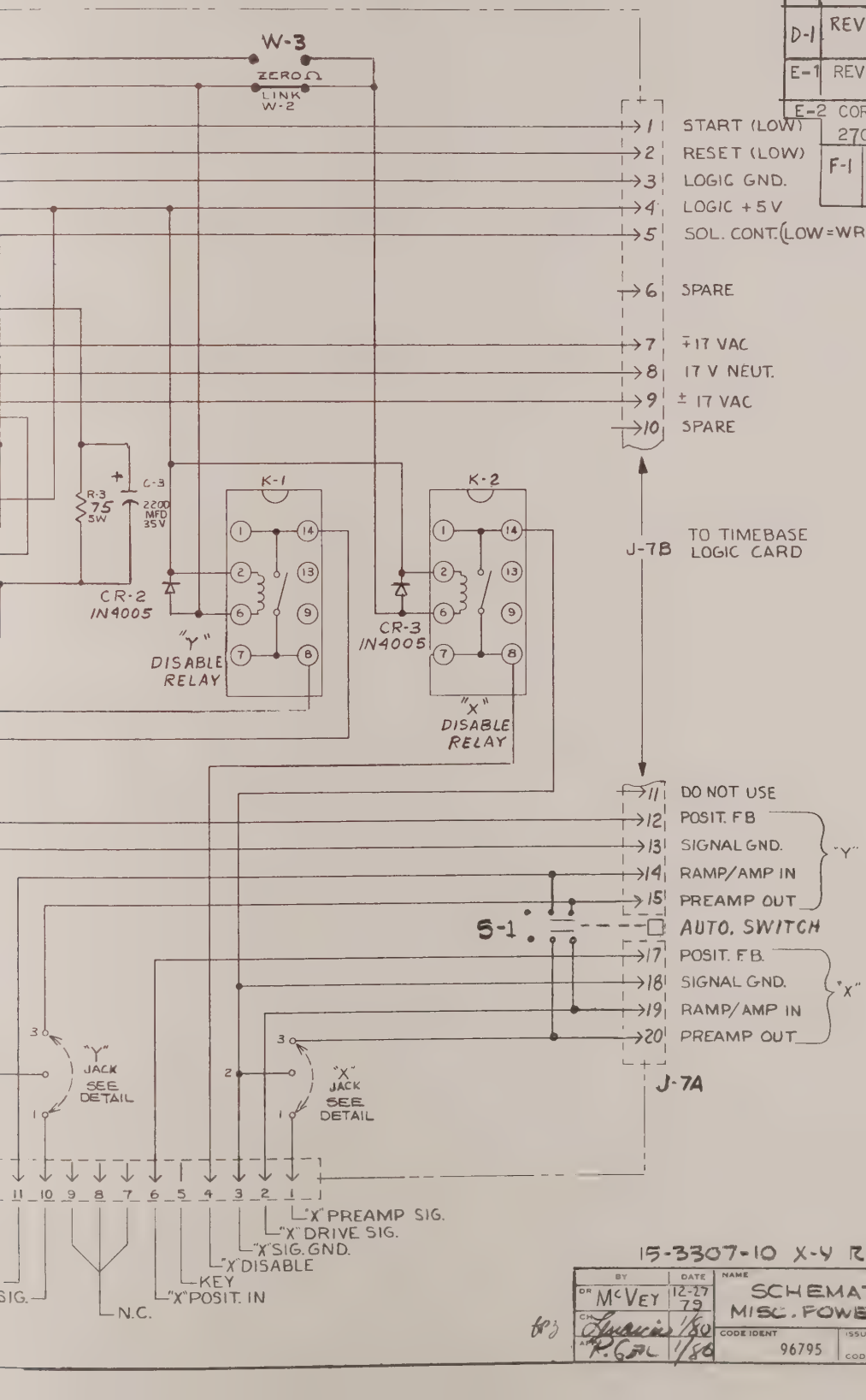
Form 2.7 3-71



NOTES:
1. EXT. DIODES FOR ± 500 VOLT CIRCUITRY REQUIRED FROM J4-3 TO J4-2 & -1 (ON PAPER HOLD SWITCH).
2. WHEN USED, TIME BASE CARD ACTUATES S-1.

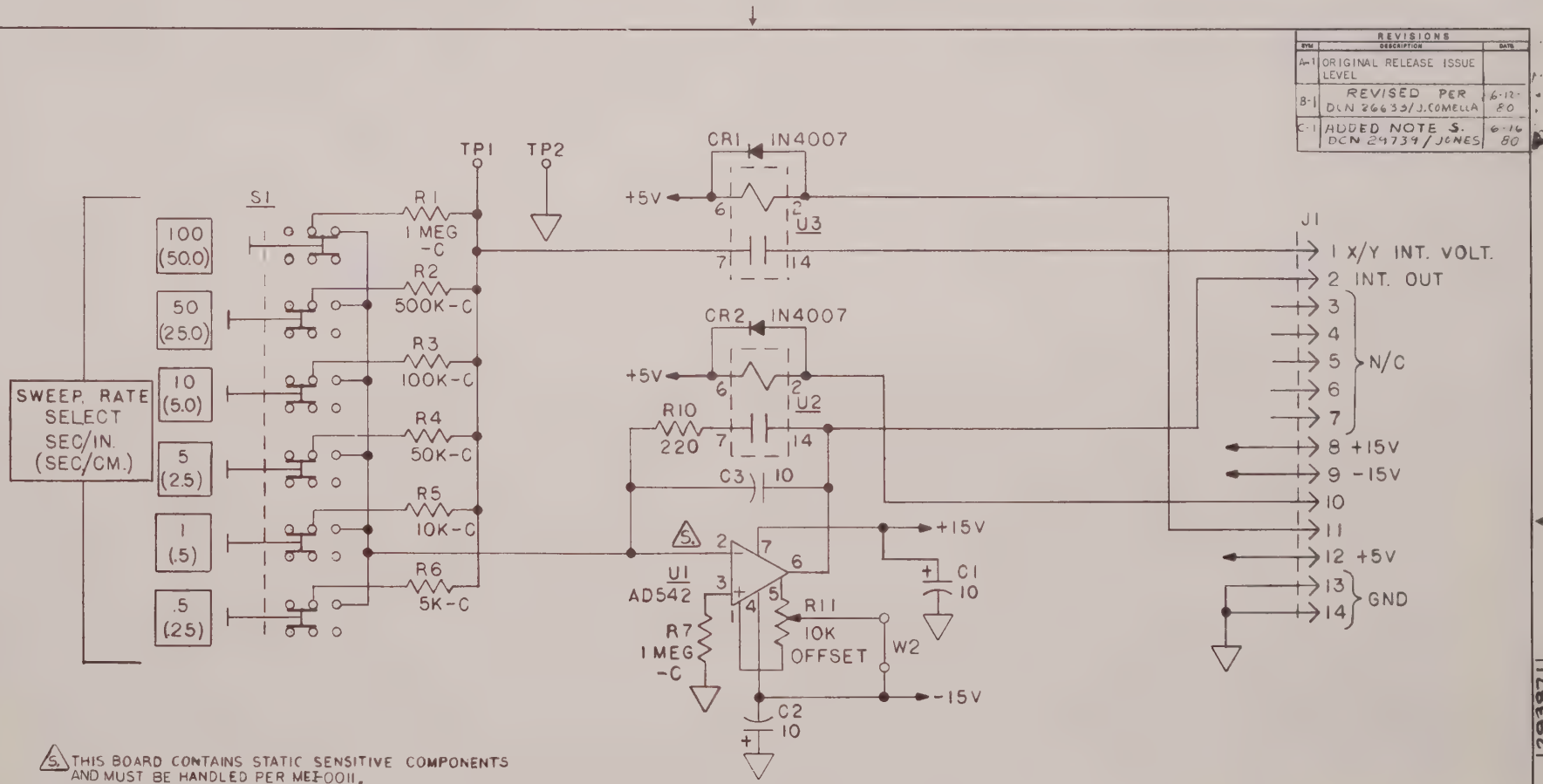
LIFT
NDBY PANEL
WITCHING
RE

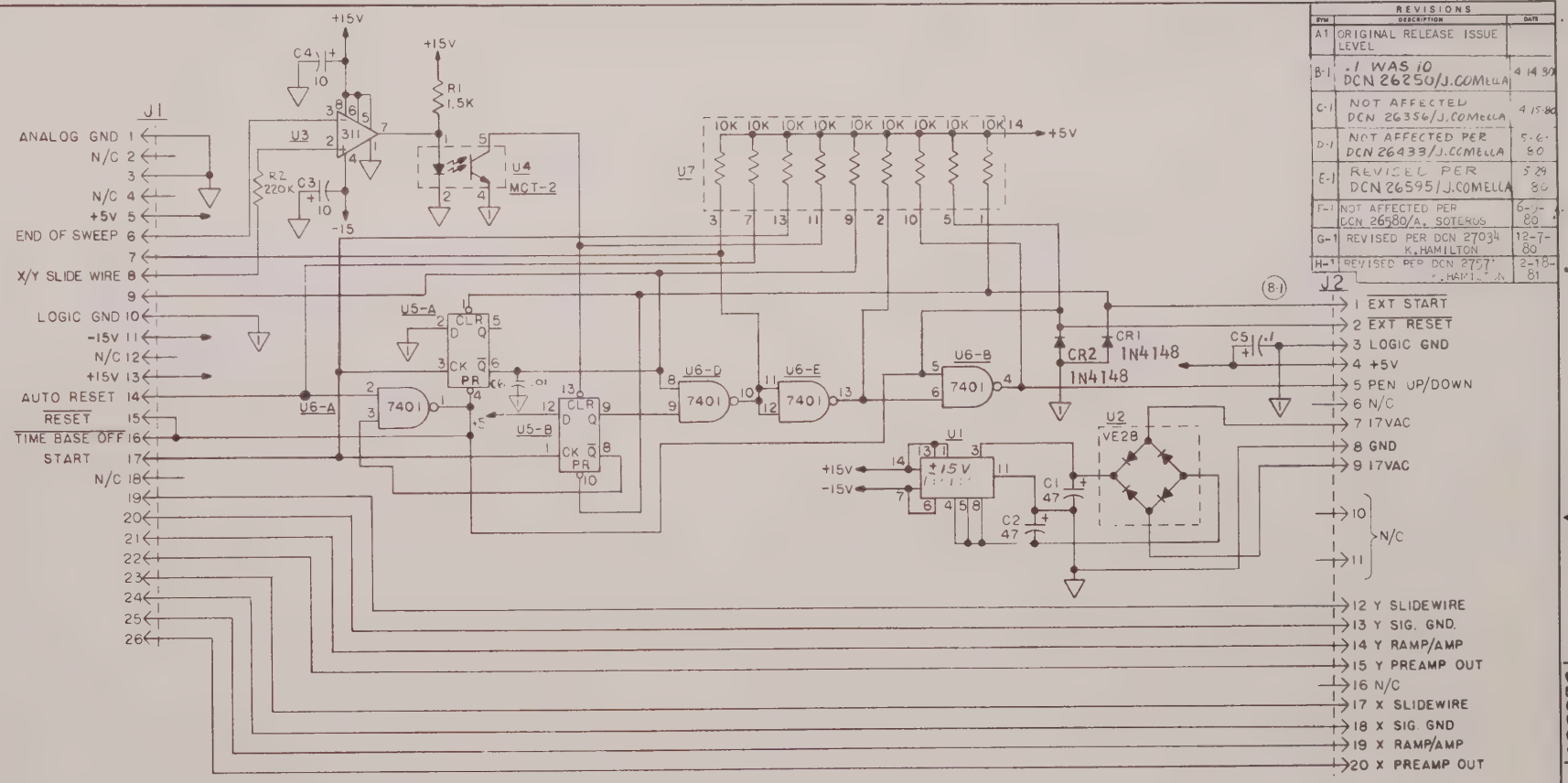
REVISIONS		
SYM.	DESCRIPTION	DATE
A-1	ORIGINAL RELEASE ISSUE LEVEL	
B-1	REVISED PER DCN 26251 F. ZAFFARANO	3-26-80
C-1	R3 WAS 39 - PER DCN 26353/J.COMELLA	4-25-80
D-1	REVISED PER DCN 26722 J.COMELLA	7-7-80
E-1	REVISED PER DCN 27033 K. HAMILTON	12-7-80
E-2	CORRECTED PER DCN 27033/K. HAMILTON	2-18-81
F-1	REV'D PER DCN 27454 S.JONES	10-14-81



15-3307-10 X-Y RECORDER

BY	DATE	NAME	Gould Inc. Instruments Division Cleveland Ohio 44114 U.S.A.
DR McVEY	12-27-79	SCHEMATIC MISC. POWER BD	
CH Ignacio	1/80	CODE IDENT 96795	DWG NO. 293867
APP P. GRL	1/80	ISSUE CODE G	


REVISIONS
SYM | DESCRIPTION | DATE
A-1 | ORIGINAL RELEASE ISSUE LEVEL |
B-1 | REVISED PER DCN 26633/J.COMELLA | 6-12-80
C-1 | ADDED NOTE 5. DCN 29739/JONES | 6-16-80
SWEEP RATE SELECT SEC/IN. (SEC/CM.)
100 (50.0)
50 (25.0)
10 (5.0)
5 (2.5)
1 (.5)
.5 (25)
S1
R1 1 MEG -C
R2 500K-C
R3 100K-C
R4 50K-C
R5 10K-C
R6 5K-C
TP1
TP2
CR1 IN4007
CR2 IN4007
+5V
U3
U2
R10 220
C3 10
U1 AD542
R7 1 MEG -C
R11 10K OFFSET
W2
C1 10
C2 10
+15V
-15V
J1
1 X/Y INT. VOLT.
2 INT. OUT
3
4
5
6
7
N/C
8 +15V
9 -15V
10
11
12 +5V
13
14
GND
5 THIS BOARD CONTAINS STATIC SENSITIVE COMPONENTS AND MUST BE HANDLED PER MEI-0011.
4. ▽ = ANALOG GND. ▽ = LOGIC GND.
3. [ ] = FRONT PANEL CONTROL
2. RESISTOR TOLERANCE B= 0.1% C= 0.25% F= 1.0%
1. UNLESS OTHERWISE INDICATED ALL CAPACITANCE IN MICROFARADS. ALL RESISTANCE IN OHMS ALL RESISTORS 5% 1/4 WATT
NOTES:
15-3307-16
MODEL NO. 15-3307-10 X-Y RECORDER
DR. R. CLARK 1/80
SCHEMATIC INTEGRATOR BOARD
CODE IDENT 96795
ISSUE G
Ideal Inc. Instruments Division Cleveland Ohio 44114 U.S.A.
293871
293871



REVISIONS		
SYM	DESCRIPTION	DATE
A1	ORIGINAL RELEASE ISSUE LEVEL	
B-1	.1 WAS 10 DCN 26250/J.COMELLA	4 14 80
C-1	NOT AFFECTED DCN 26356/J.COMELLA	4 15 80
D-1	NOT AFFECTED PER DCN 26433/J.COMELLA	5-6-80
E-1	REVISED PER DCN 26595/J.COMELLA	5 29 80
F-1	NOT AFFECTED PER DCN 26580/A. SOTEROS	6-1-80
G-1	REVISED PER DCN 27034 K.HAMILTON	12-7-80
H-1	REVISED PER DCN 2757 K.HAMILTON	2-18-81

I.C.	+5V	▽
U5, U6	14	7

4. ▽ = ANALOG GND.
   ▽ = LOGIC GND.
3. [ ] = FRONT PANEL CONTROL
2. RESISTOR TOLERANCE
   B = 0.1%
   C = 0.25%
   F = 1.0%
1. UNLESS OTHERWISE INDICATED ALL CAPACITANCE IN MICROFARADS.
   ALL RESISTANCE IN OHMS
   ALL RESISTORS 5% 1/4 WATT

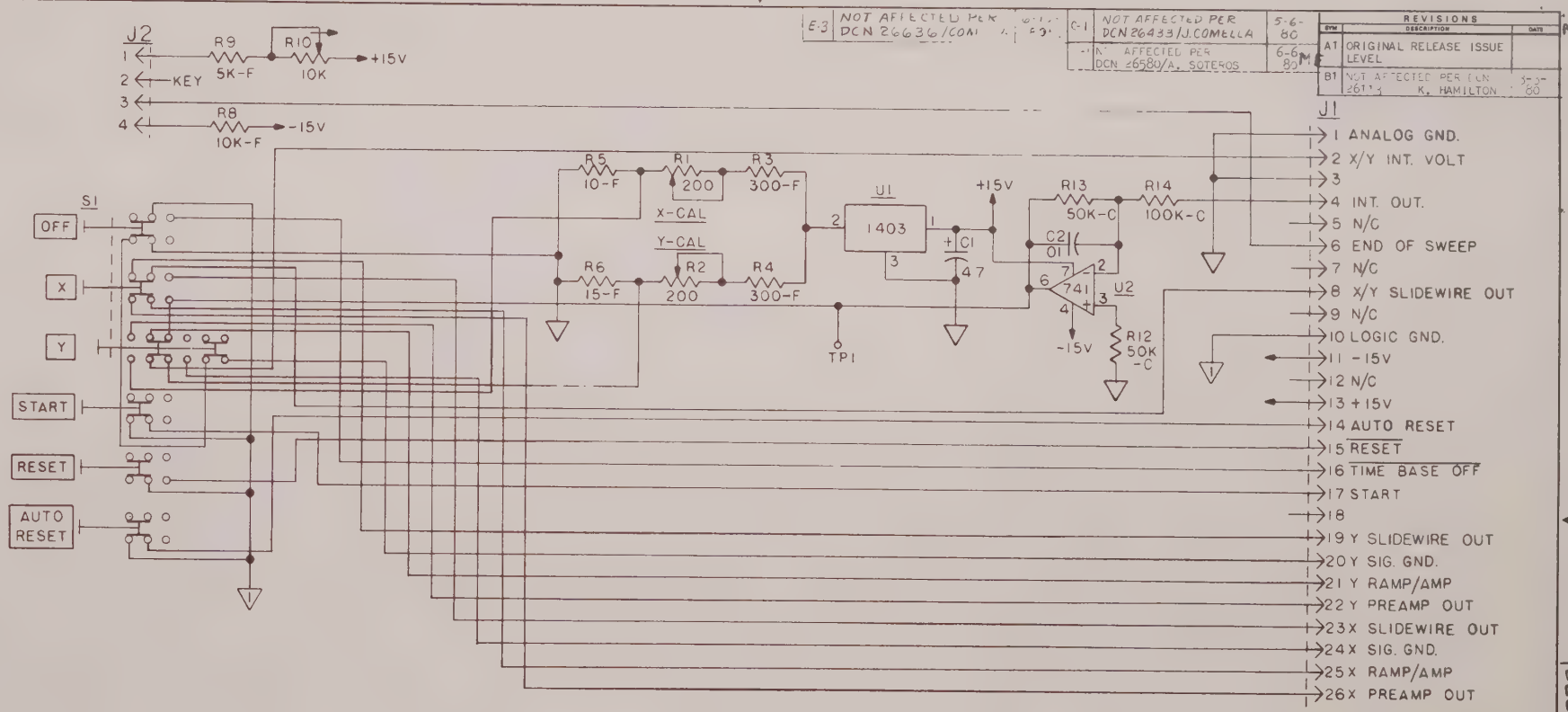
NOTES:

MODEL NO. 15-3307-10 X-Y RECORDER

BY	DATE	NAME	
DR. R. CLARK	1-9-80	SCHEMATIC LOGIC BOARD	Gould Inc. Instruments Division Cleveland, Ohio 44114 U.S.A.
CH.			
APP. R.C.	1/16	ORIG. SHEET 96795	SIZE CODE 6

293872

82 81



E-3 NOT AFFECTED PER DCN 26636/CONI 5-6-80

C-1 NOT AFFECTED PER DCN 26433/J.COMELLA 5-6-80

-- NOT AFFECTED PER DCN 26580/A. SOTEROS 6-6-80

REVISIONS		
SYM	DESCRIPTION	DATE
A1	ORIGINAL RELEASE ISSUE LEVEL	
B1	NOT AFFECTED PER ECN 26119 K. HAMILTON	5-5-80

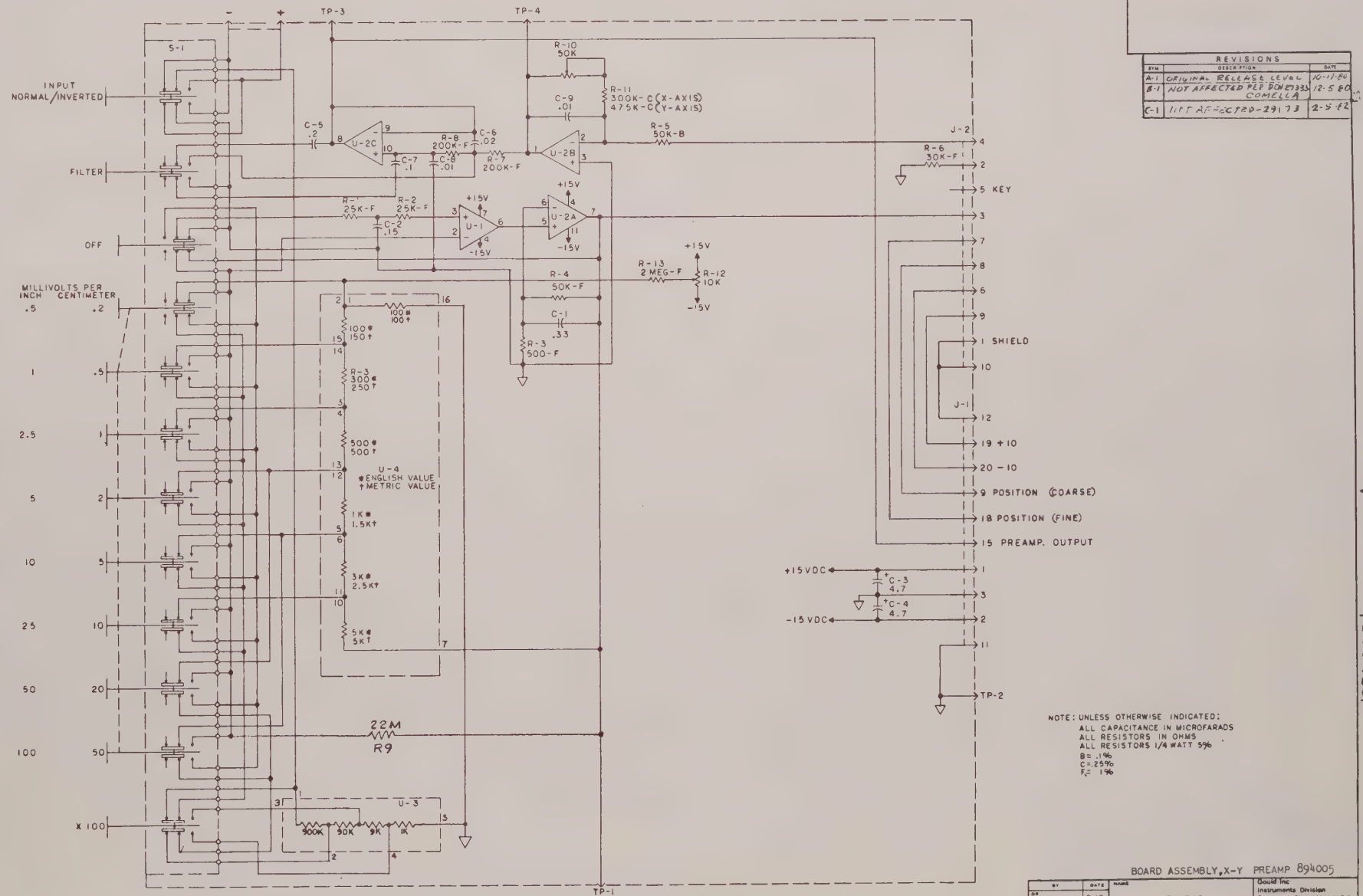
5. ARROW INDICATES CLOCKWISE ROTATION.
4. ▽ = ANALOG GND.
   ▽ = LOGIC GND.
3. [ ] = FRONT PANEL CONTROL
2. RESISTOR TOLERANCE
   B = 0.1 %
   C = 0.25 %
   F = 1.0 %
1. UNLESS OTHERWISE INDICATED ALL
   CAPACITANCE IN MICROFARADS.
   ALL RESISTANCE IN OHMS
   ALL RESISTORS 5% 1/4 WATT

NOTES:

13-3307-16
MODEL NO. 13-3307-10 X-Y RECORDER

	BY	DATE	NAME	SCHEMATIC CONTROL BOARD	Gould Inc Instruments Division Cleveland, Ohio 44114 U.S.A.
DR	R. CLARK	1-9-80			
CH		1/80			
APP	R. COEL	1/80	CODE IDENT 96795	ISSUE CODE 6	SIZE D 293873

293873



REVISIONS		
SYM	DESCRIPTION	DATE
A-1	ORIGINAL RELEASE LEVEL	10-11-80
B-1	NOT AFFECTED PER DCN 7333 COMELLA	12-5-80
C-1	NOT AFFECTED PER 29173	2-5-82

NOTE: UNLESS OTHERWISE INDICATED:
ALL CAPACITANCE IN MICROFARADS
ALL RESISTORS IN OHMS
ALL RESISTORS 1/4 WATT 5%
B= .1%
C=.25%
F= 1%

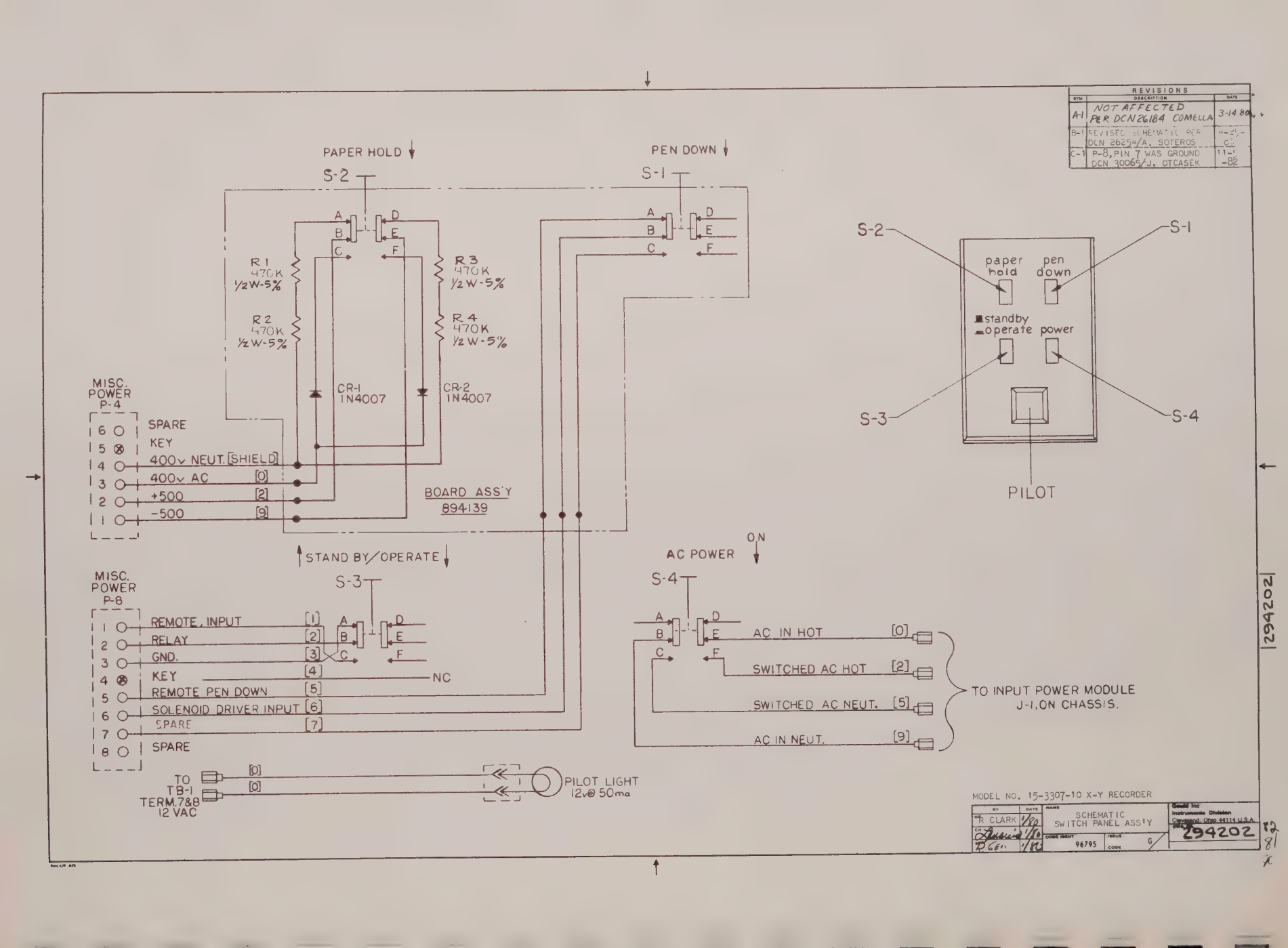
BOARD ASSEMBLY, X-Y PREAMP 894005

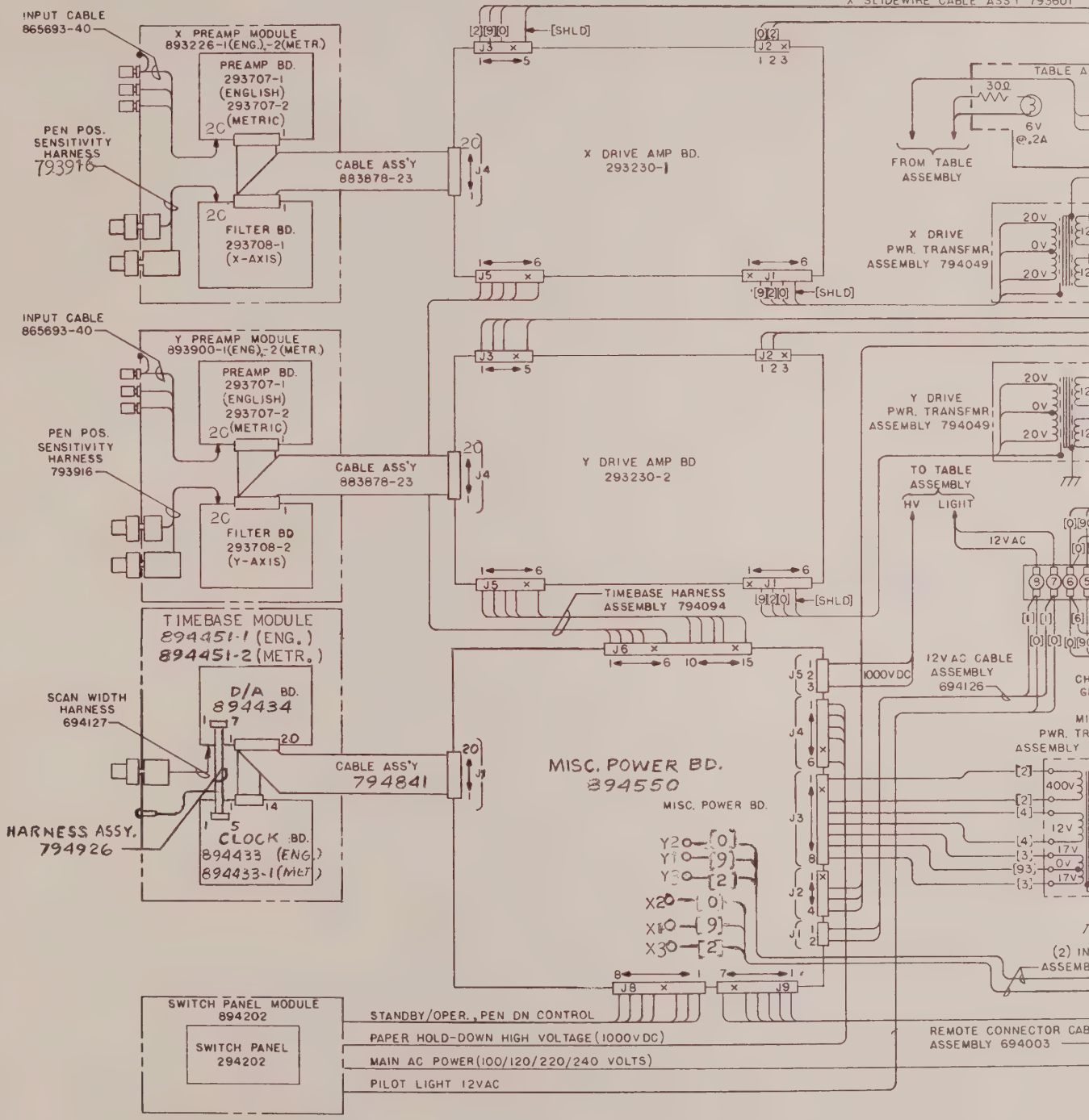
BY	DATE	NAME
DR FOWLER	8/80	SCHEMATIC
CHK		
APP		

CODE IDENT 96795 | SIZE G | CODE | DWG NO 294005

Gould Inc
Instruments Division
Cleveland Ohio 44114 U.S.A.

294005

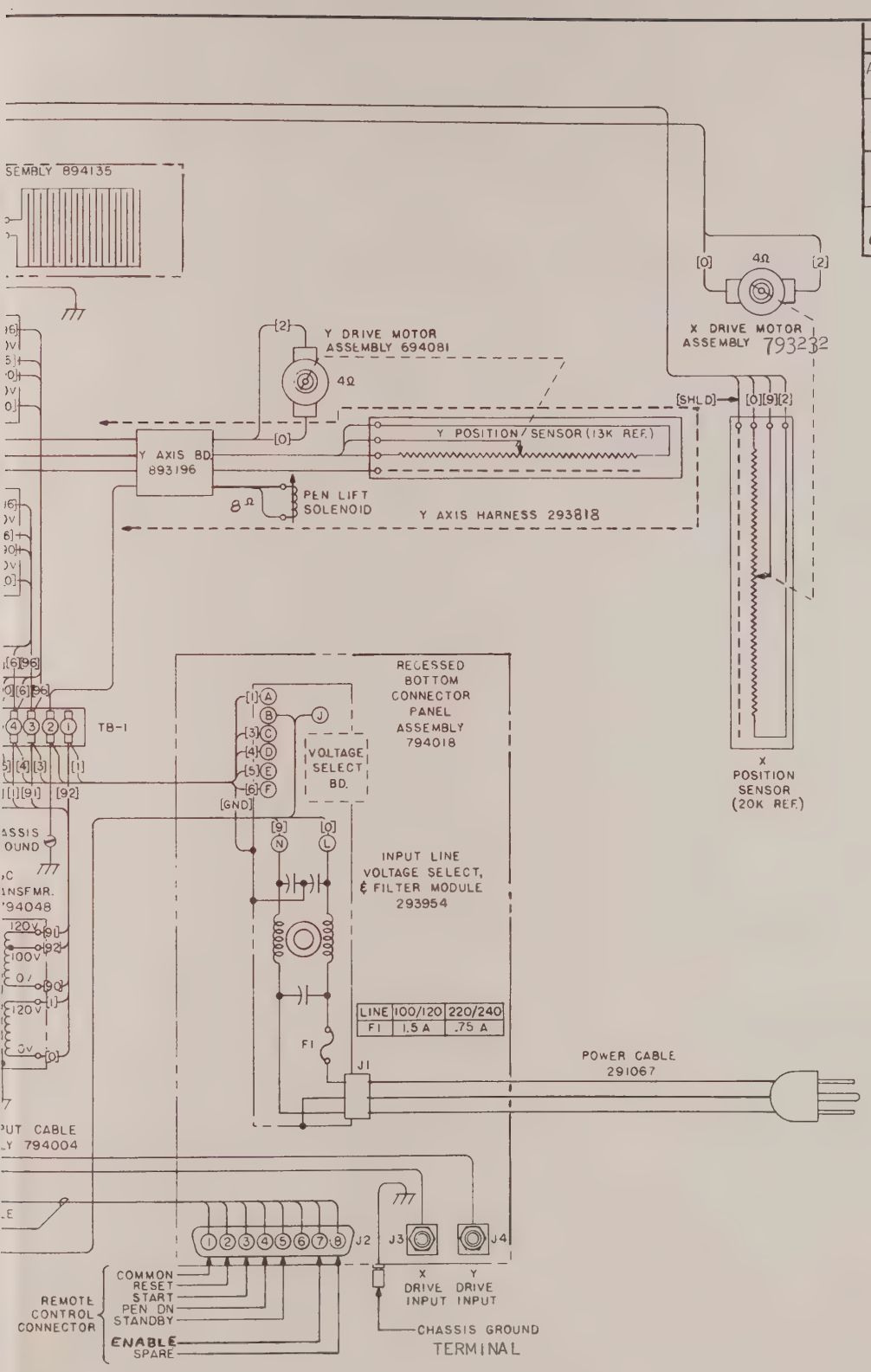

REVISIONS
SYM | DESCRIPTION | DATE
A-1 NOT AFFECTED PER DCN 26184 COMELLA 3-14-80
B-1 REVISED SCHEMATIC PER DCN 26254/A. SOTEROS 4-25-
C-1 P-8, PIN 7 WAS GROUND DCN 30065/J. OTCASEK 11-
-82
PAPER HOLD
S-2
PEN DOWN
S-1
R1 470K ½W-5%
R2 470K ½W-5%
R3 470K ½W-5%
R4 470K ½W-5%
CR-1 1N4007
CR-2 1N4007
MISC. POWER P-4
SPARE
KEY
400v NEUT. [SHIELD]
400v AC [0]
+500 [2]
-500 [9]
BOARD ASS'Y 894139
S-2
S-1
paper hold
pen down
standby
operate power
S-3
S-4
PILOT
STAND BY/OPERATE
S-3
AC POWER ON
S-4
MISC. POWER P-8
REMOTE INPUT [1]
RELAY [2]
GND. [3]
KEY [4]
NC
REMOTE PEN DOWN [5]
SOLENOID DRIVER INPUT [6]
SPARE [7]
SPARE
AC IN HOT [0]
SWITCHED AC HOT [2]
SWITCHED AC NEUT. [5]
AC IN NEUT. [9]
TO INPUT POWER MODULE J-1, ON CHASSIS.
TO TB-1 TERM. 7&8 12 VAC
[0]
[0]
PILOT LIGHT 12v@ 50ma
MODEL NO. 15-3307-10 X-Y RECORDER
BY R CLARK 1/80
SCHEMATIC SWITCH PANEL ASS'Y
Gould Inc. Instruments Division Cleveland, Ohio 44114 U.S.A.
294202
CODE IDENT 96795
ISSUE CODE G
294202



6. REMOTE INPUT "COMMON" IS FLOATING (± 100V DC) WITH RESPECT TO CHASSIS OR SIGNAL INPUTS.
5. HEAT SINKS ON DRIVE AMPLIFIERS ARE AT CHASSIS GROUND (ISOLATED FROM CIRCUIT GROUND).
4. NUMBERS BEGINNING WITH 6, 7, OR 8, ARE ASSEMBLY DRAWINGS.
3. NUMBERS GIVEN AS 2XXXXX ARE SCHEMATIC DIAGRAM DRAWINGS.
2. X = POLARIZING KEY
1. [ ] = E.I.A. COLOR CODE

NOTES;

REVISIONS		
SYM.	DESCRIPTION	DATE
A-1	REVISED SCHEMATIC PER DCN 25984/A. SOTEROS	2-4-80
B-1	REVISED PER DCN 26352 J.COMELLA	4-22-80
B-2	REVISED PER DCN 26384 J.COMELLA	4-22-80
C-1	REVISED PER DCN 27673 J.COMELLA	2-6-81



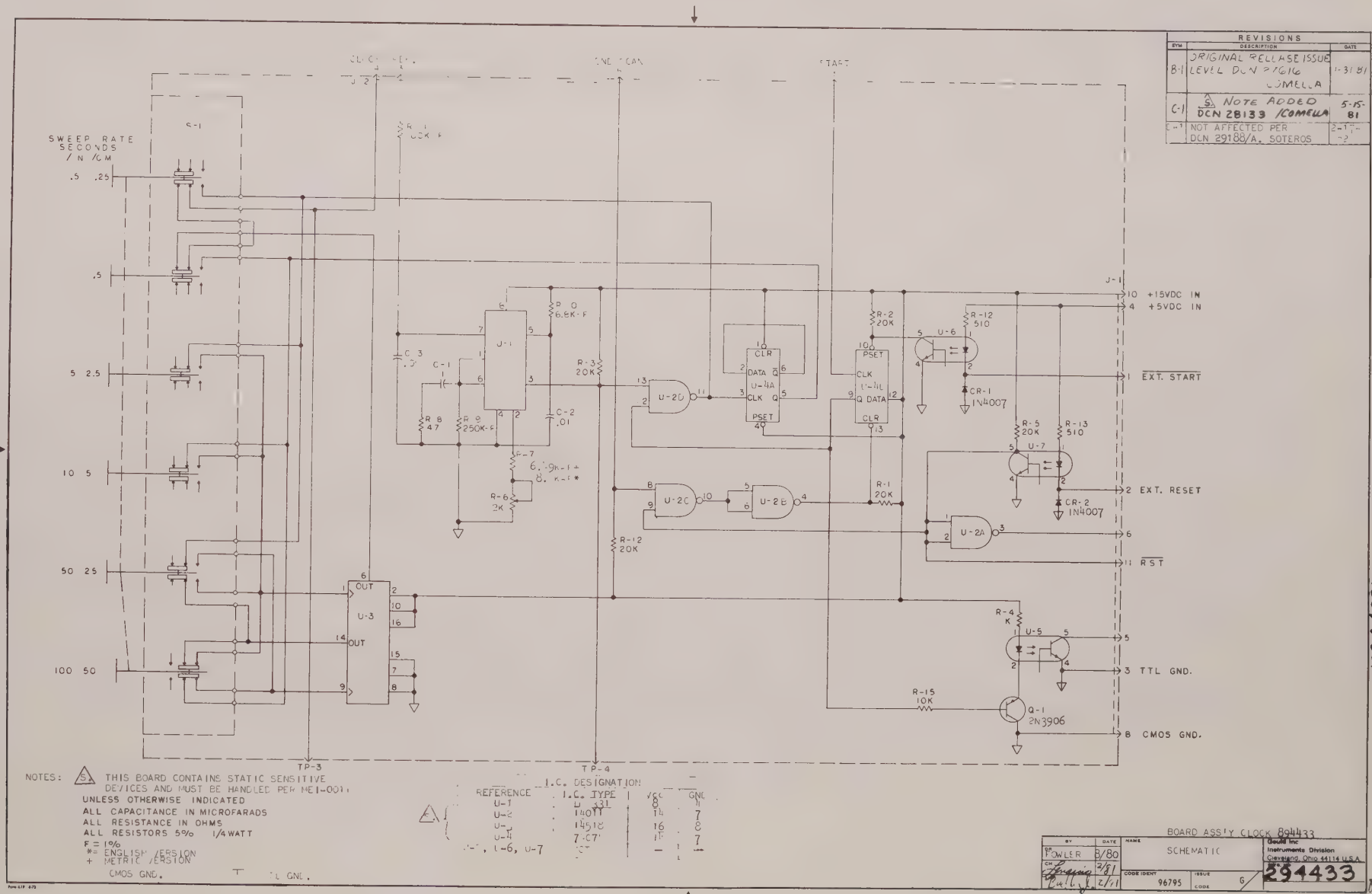
15-3307-10 X-Y RECORDER

	BY	DATE	NAME
DR.	R. CLARK	1/12/80	SYSTEM SCHEMATIC
CH.	Lyncis	1/20	
APP.	P. Geil	1/30	

CODE IDENT. 96795 | ISSUE CODE G

Gould Inc.
Instruments Division
Cleveland, Ohio 44114 U.S.A.

DWG. NO. 294224



NOTES:
1. THIS BOARD CONTAINS STATIC SENSITIVE DEVICES AND MUST BE HANDLED PER ME1-0011
2. UNLESS OTHERWISE INDICATED
3. ALL CAPACITANCE IN MICROFARADS
4. ALL RESISTANCE IN OHMS
5. ALL RESISTORS 5% 1/4 WATT
6. F = 1%
7. * = ENGLISH VERSION
8. + = METRIC VERSION

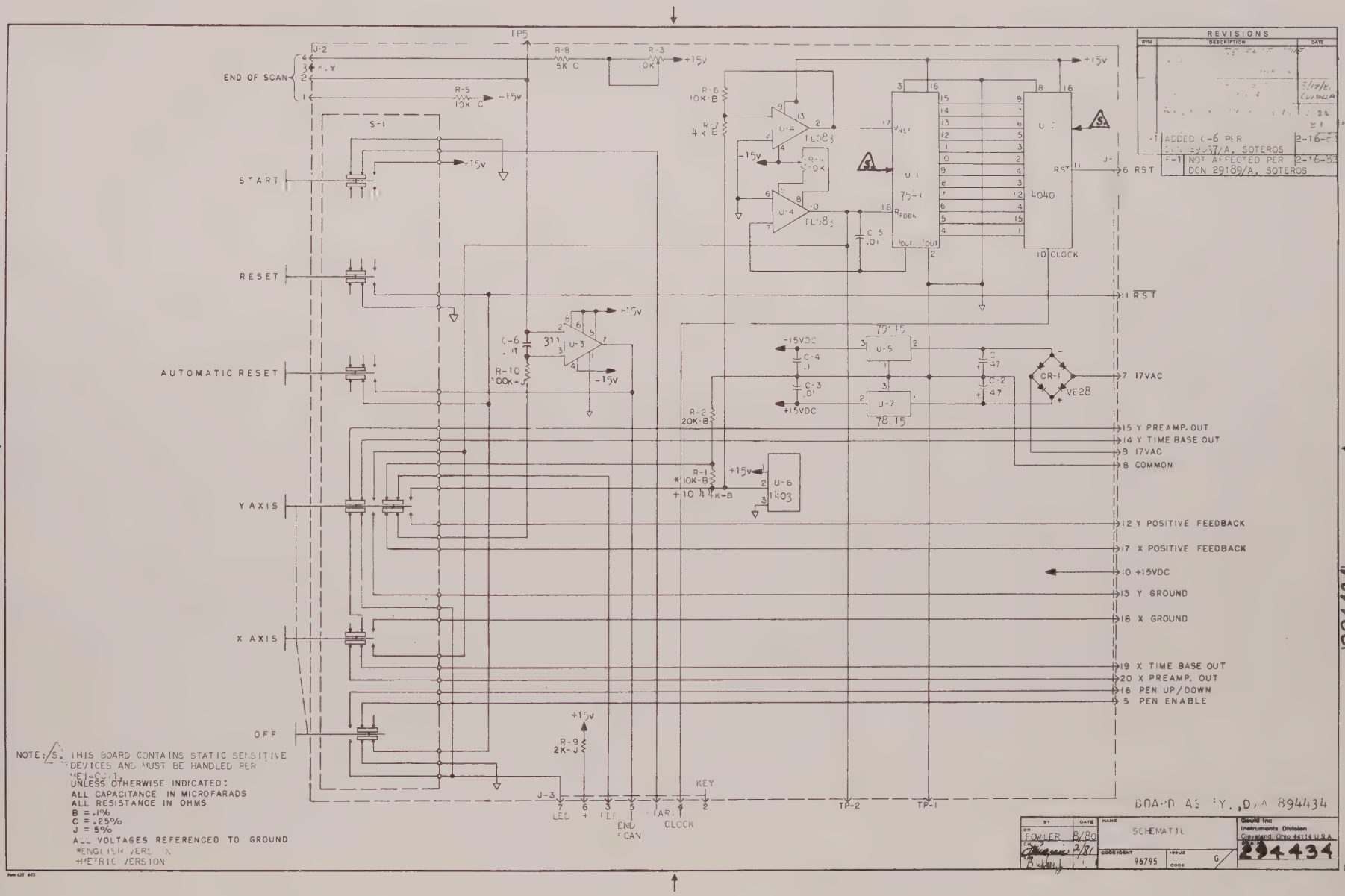
REFERENCE	I.C. DESIGNATION	VCC	GND
U-1	LM 331	8	1
U-2	14011	14	7
U-3	14518	16	8
U-4	7 C 73	14	7
U-5, U-6, U-7			

BOARD ASS'Y CLOCK 894433

BY	DATE	NAME	Gould Inc Instruments Division Cleveland, Ohio 44114 U.S.A.
FOWLER	8/80	SCHEMATIC	
CH	2/81		
	2/1/1	CODE IDENT 96795	ISSUE CODE G

294433

294433



NOTE: ⚠S. THIS BOARD CONTAINS STATIC SENSITIVE DEVICES AND MUST BE HANDLED PER MIL-STD-1.
UNLESS OTHERWISE INDICATED:
ALL CAPACITANCE IN MICROFARADS
ALL RESISTANCE IN OHMS
B = .1%
C = .25%
J = 5%
ALL VOLTAGES REFERENCED TO GROUND
*ENGLISH VERSION
+METRIC VERSION

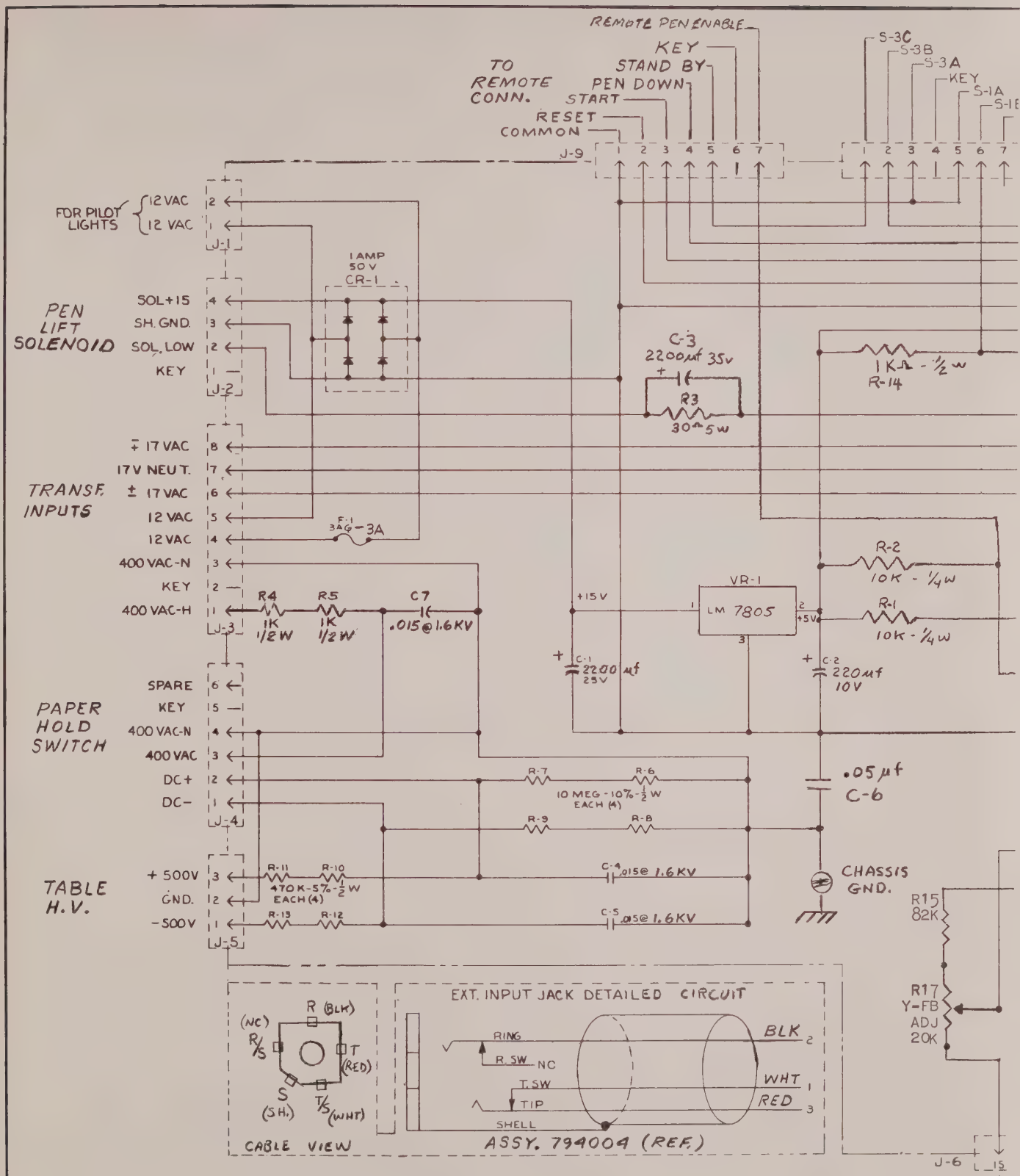
REVISIONS		
SYM	DESCRIPTION	DATE
-1	ADDED C-6 PER DCN 29237/A, SOTEROS	2-16-83
-1	NOT AFFECTED PER DCN 29189/A, SOTEROS	2-16-83

BY	DATE	NAME	Gould Inc Instruments Division Cleveland Ohio 44114 U.S.A.
DR FOWLER	8/80	SCHEMATIC	
CH	2/81		
A		CODE IDENT 96795	ISSUE CODE G
			SIZE 294434

BOARD AS Y, D, A 894434

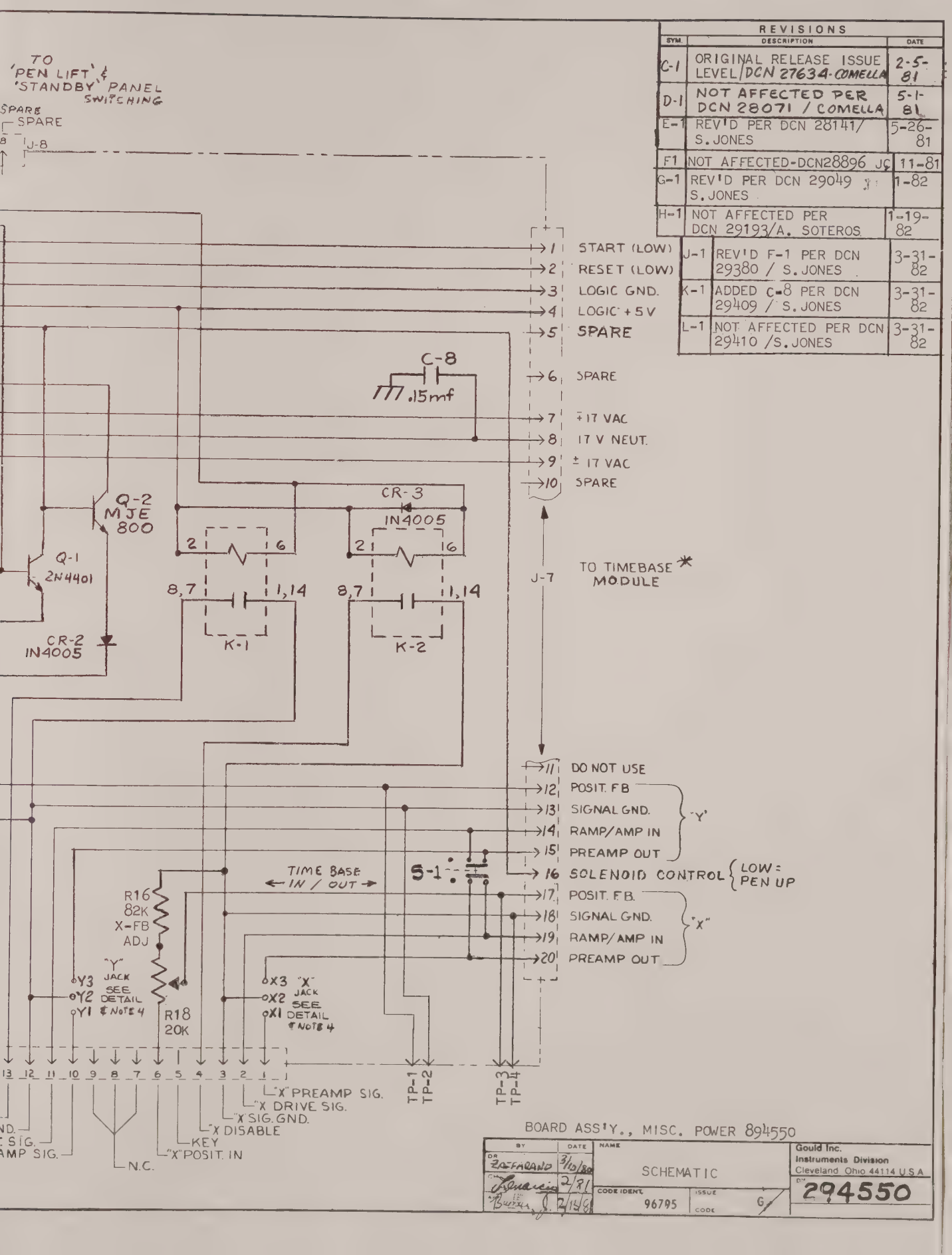
294434

X2



NOTES:

1. EXT. DIODES FOR ± 500 VOLT CIRCUITRY REQUIRED FROM J4-3 TO J4-2 & -1 (ON PAPER HOLD SWITCH).
2. SWITCH S-1 MUST BE SET FOR TIME BASE IN/OUT.
3. K1 & K2 MAY INCORPORATE INTERNAL DIODES IN PARALLEL TO CR-2,
4. JUMPER PINS 1 & 3 WHEN EXT. INPUT ASS'Y 794004 IS REMOVED.


TO 'PEN LIFT' & 'STANDBY' PANEL SWITCHING
SPARE
SPARE
J-8
REVISIONS
SYM. DESCRIPTION DATE
C-1 ORIGINAL RELEASE ISSUE LEVEL/DCN 27634-COMELLA 2-5-81
D-1 NOT AFFECTED PER DCN 28071 / COMELLA 5-1-81
E-1 REV'D PER DCN 28141/ S. JONES 5-26-81
F1 NOT AFFECTED-DCN28896 JC 11-81
G-1 REV'D PER DCN 29049 S. JONES 1-82
H-1 NOT AFFECTED PER DCN 29193/A. SOTEROS 1-19-82
J-1 REV'D F-1 PER DCN 29380 / S. JONES 3-31-82
K-1 ADDED C-8 PER DCN 29409 / S. JONES 3-31-82
L-1 NOT AFFECTED PER DCN 29410 /S. JONES 3-31-82
1 START (LOW)
2 RESET (LOW)
3 LOGIC GND.
4 LOGIC +5V
5 SPARE
6 SPARE
7 ±17 VAC
8 17 V NEUT.
9 ±17 VAC
10 SPARE
C-8
.15mf
Q-2 MJE 800
Q-1 2N4401
CR-2 IN4005
CR-3 IN4005
2
6
8,7
1,14
K-1
K-2
J-7
TO TIMEBASE MODULE *
11 DO NOT USE
12 POSIT. FB
13 SIGNAL GND.
14 RAMP/AMP IN
15 PREAMP OUT
"Y"
16 SOLENOID CONTROL LOW = PEN UP
17 POSIT. F.B.
18 SIGNAL GND.
19 RAMP/AMP IN
20 PREAMP OUT
"X"
TIME BASE IN / OUT
S-1
R16 82K X-FB ADJ
R18 20K
Y3 JACK SEE DETAIL & NOTE 4
Y2
Y1
X3 "X" JACK
X2 SEE DETAIL & NOTE 4
X1
TP-1
TP-2
TP-3
TP-4
"X" PREAMP SIG.
"X" DRIVE SIG.
"X" SIG. GND.
"X" DISABLE
KEY
"X" POSIT. IN
N.C.
BOARD ASS'Y., MISC. POWER 894550
BY DATE
DR ZAFFARANO 3/10/80
CH Ignacio 2/81
Burton J. 2/15/82
NAME SCHEMATIC
CODE IDENT. 96795
ISSUE CODE G
Gould Inc.
Instruments Division
Cleveland Ohio 44114 U.S.A.
DWG 294550

REVISIONS		
SYM	DESCRIPTION	DATE
B-1	ORIGINAL RELEASE ISSUE LEVEL/DCN 27595 .. COMELLA	1/6/81
C-1	NOT AFFECTED PER DCN 28020/J.COMELLA	4/21/81
D-1	NOT AFFECTED PER DCN 29158/A. SOTEROS	2-12-82
E-1	NOT AFFECTED PER DCN 29651/COMELLA	5-13-82

TYPE	L2
ENGLISH	294861
MET	294864

TO FRONT PANEL BINDING POST

R1

INPUT RANGE MV/INCH (MV/CM)

NORM INV
OFF
.25 (.1)
.5 (.2)
1.0 (.5)
2.5 (1)
5 (2)
10 (5)
X1 X100

S1

(BIAS)

IN3595

S6

J4
1 GND
2 CHOPPER OUT
3 NORM OUT
4 INV OUT
5 PREAMP OUT
6 + 15 V
7 ANALOG GND
8 - 15 V
9 + 10 V
10 - 10 V

= FRONT PANEL

ALL CAPACITORS IN MICROFARAD
ALL RESISTORS IN OHMS
C = .25 %
F = 1.0 %
J = 5.0 %

BD, ASS'Y PRE-AMP 894770

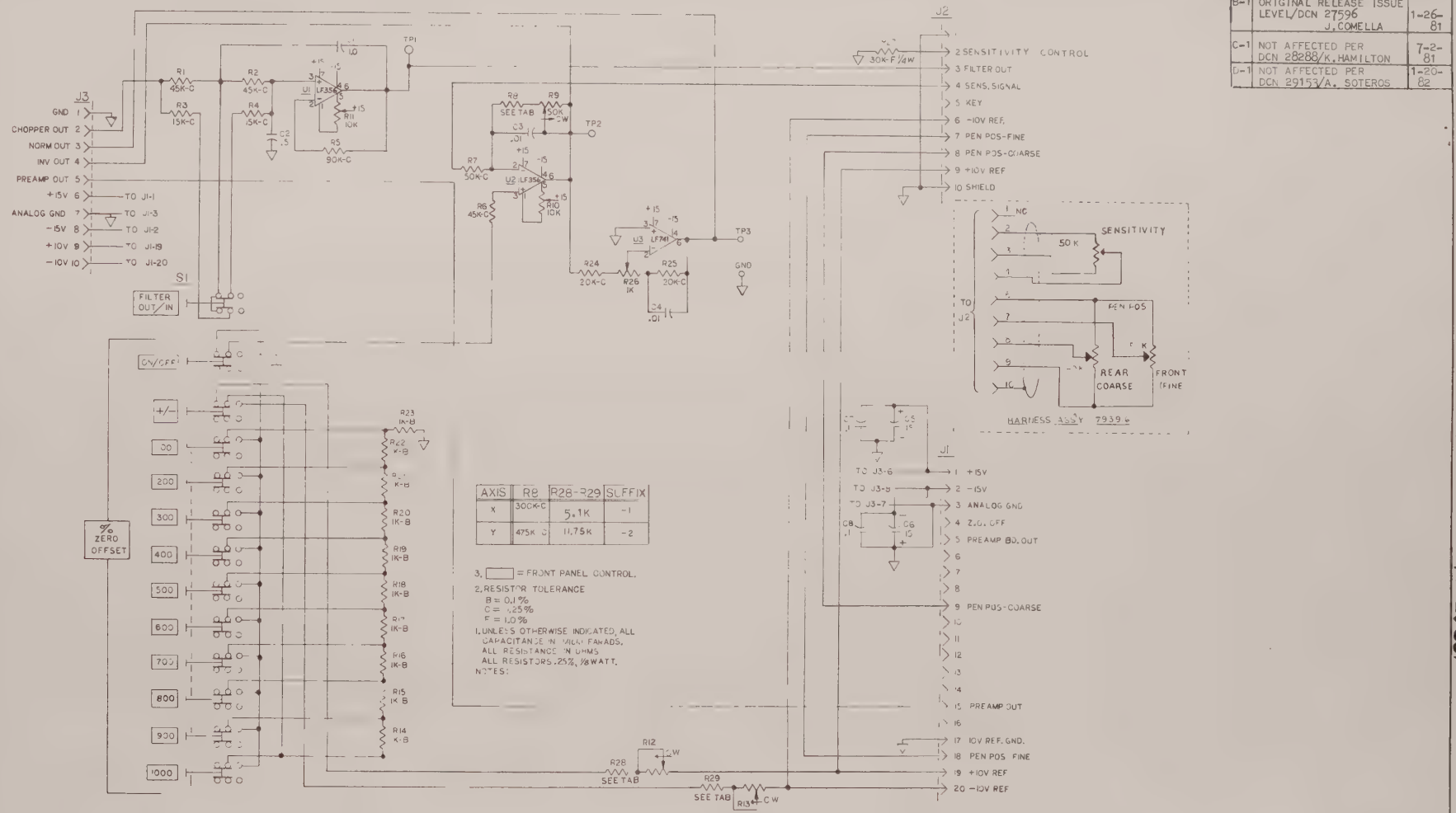
BY	DATE	NAME
DR COMELLA	1/27 81	SCHEMATIC
CH	1/31/81	
APP	2/26/81	

CODE IDENT. 96795 ISSUE CODE G

Gould Inc
Instruments Division
Cleveland, Ohio 44114 U.S.A.
894770

894770

87



AXIS	R8	R28-R29	SUFFIX
X	300K-C	5.1K	-1
Y	475K-C	11.75K	-2

3. [ ] = FRONT PANEL CONTROL.
2. RESISTOR TOLERANCE
   B = 0.1%
   C = 0.25%
   F = 1.0%
1. UNLESS OTHERWISE INDICATED, ALL CAPACITANCE IN MICROFARADS, ALL RESISTANCE IN OHMS ALL RESISTORS .25%, 1/8 WATT.

NOTES:

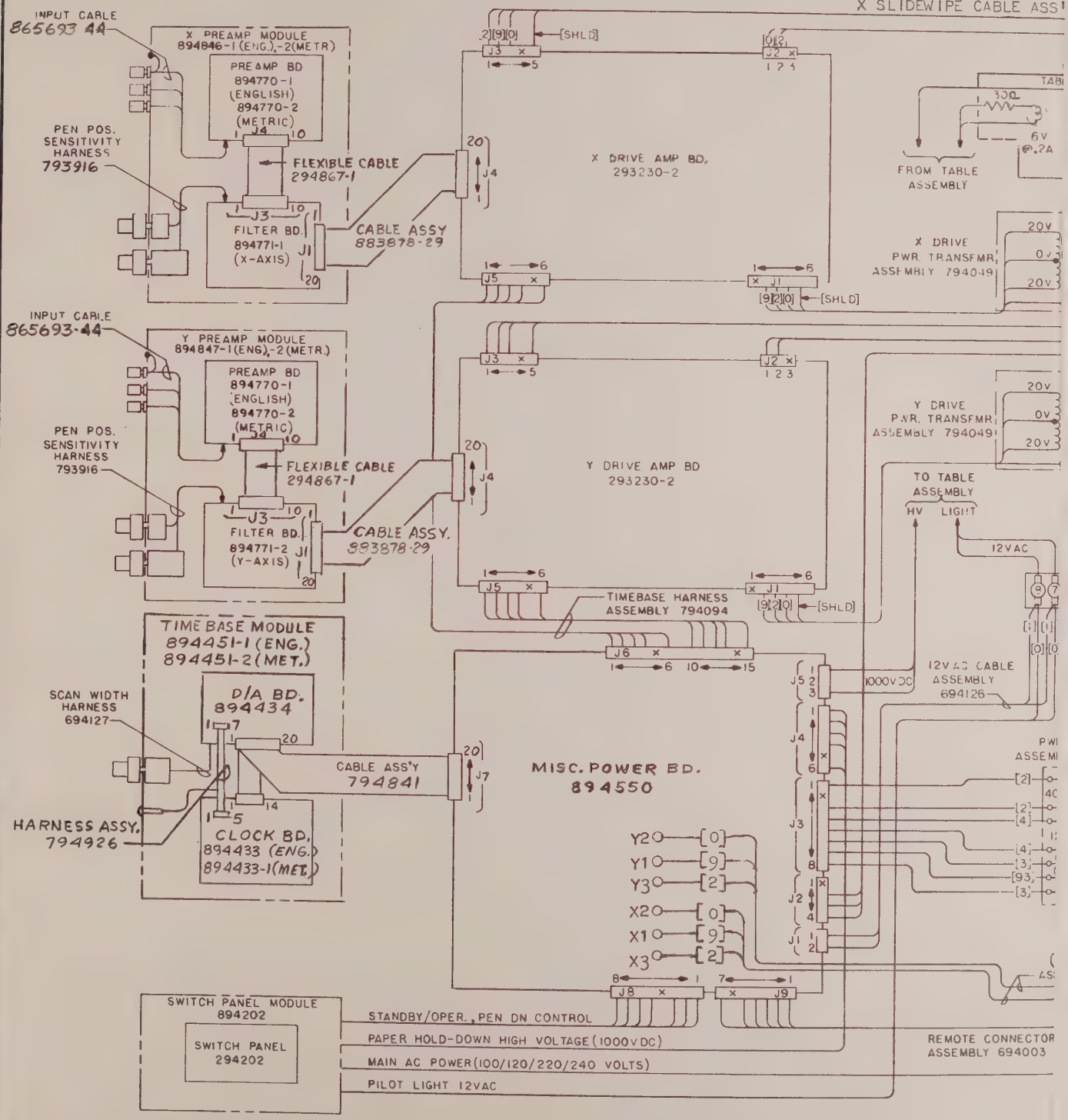
REVISIONS			
SYM	DESCRIPTION	DATE
B-1	ORIGINAL RELEASE ISSUE LEVEL/DCN 27596 J. COMELLA	1-26-81
C-1	NOT AFFECTED PER DCN 28288/K. HAMILTON	7-2-81
D-1	NOT AFFECTED PER DCN 29153/A. SOTEROS	1-20-82

BD. ASS'Y., FILTER 894771

BY	DATE	NAME	
DR COMELLA	1-26-81	SCHEMATIC	Gould Inc. Instruments Division Cleveland, Ohio 44114 U.S.A.
CH Ramirez	1-26-81		
APP Russell Yoder	1-26-81	CODE IDENT 96795	SIZE G 894771

894771

82
91



NOTES:
1. [ ] = E.I.A. COLOR CODE
2. X=POLARIZING KEY
3. NUMBERS GIVEN AS 2XXXXX ARE SCHEMATIC DIAGRAM DRAWINGS.
4. NUMBERS BEGINING WITH 6, 7, OR 8, ARE ASSEMBLY DRAWINGS.
5. HEAT SINKS ON DRIVE AMPLIFIERS ARE AT CHASSIS GROUND (ISOLATED FROM CIRCUIT GROUND).
6. REMOTE INPUT "COMMON" IS FLOATING (± 100V DC) WITH RESPECT TO CHASSIS OR SIGNAL INPUTS.

REVISIONS		
SYM.	DESCRIPTION	DATE
A-1	REVISED PER DCN 27673 J.COMELLA	2-9-80

Y 793601

E ASSEMBLY 894135

[96] 120V [6] [90] 120V [0]

[2] Y DRIVE MOTOR ASSEMBLY 694081 4Ω

[0] 4Ω [2] X DRIVE MOTOR ASSEMBLY 693093

[SHLD] [0] [9] [2]

Y AXIS BD 893196

[0] Y POSITION SENSOR (13K REF.)

32Ω PEN LIFT SOLENOID

Y AXIS HARNESS 293372

X POSITION SENSOR (20K REF.)

[96] 120V [6] [90] 120V [0]

[0] [90] [6] [96]

[0] [90] [6] [96]

TB-1

[6] [5] [4] [3] [1]

[0] [90] [1] [91] [92]

CHASSIS GROUND

MISC. R. TRANSFMR. BLY 794048

120V [91] [92] 100V [0] [90] 120V [1] 0V [0]

) INPUT CABLE EMBLY 794004

CABLE

RECESSED BOTTOM CONNECTOR PANEL ASSEMBLY 794018

[1] A [B] [J] [3] C [4] D [5] E [6] F [GND]

VOLTAGE SELECT BD.

[9] N [0] L

INPUT LINE VOLTAGE SELECT, & FILTER MODULE 293954

LINE	100/120	220/240
F1	1.5 A	.75 A

F1

J1

POWER CABLE 291067

1 2 3 4 5 6 7 8 J2 J3 J4

REMOTE CONTROL CONNECTOR

COMMON
RESET
START
PEN DN
STANDBY
ENABLE
SPARE

X DRIVE INPUT

Y DRIVE INPUT

CHASSIS GROUND

15-3307-01, 07, 11, 17 X-Y RECORDER

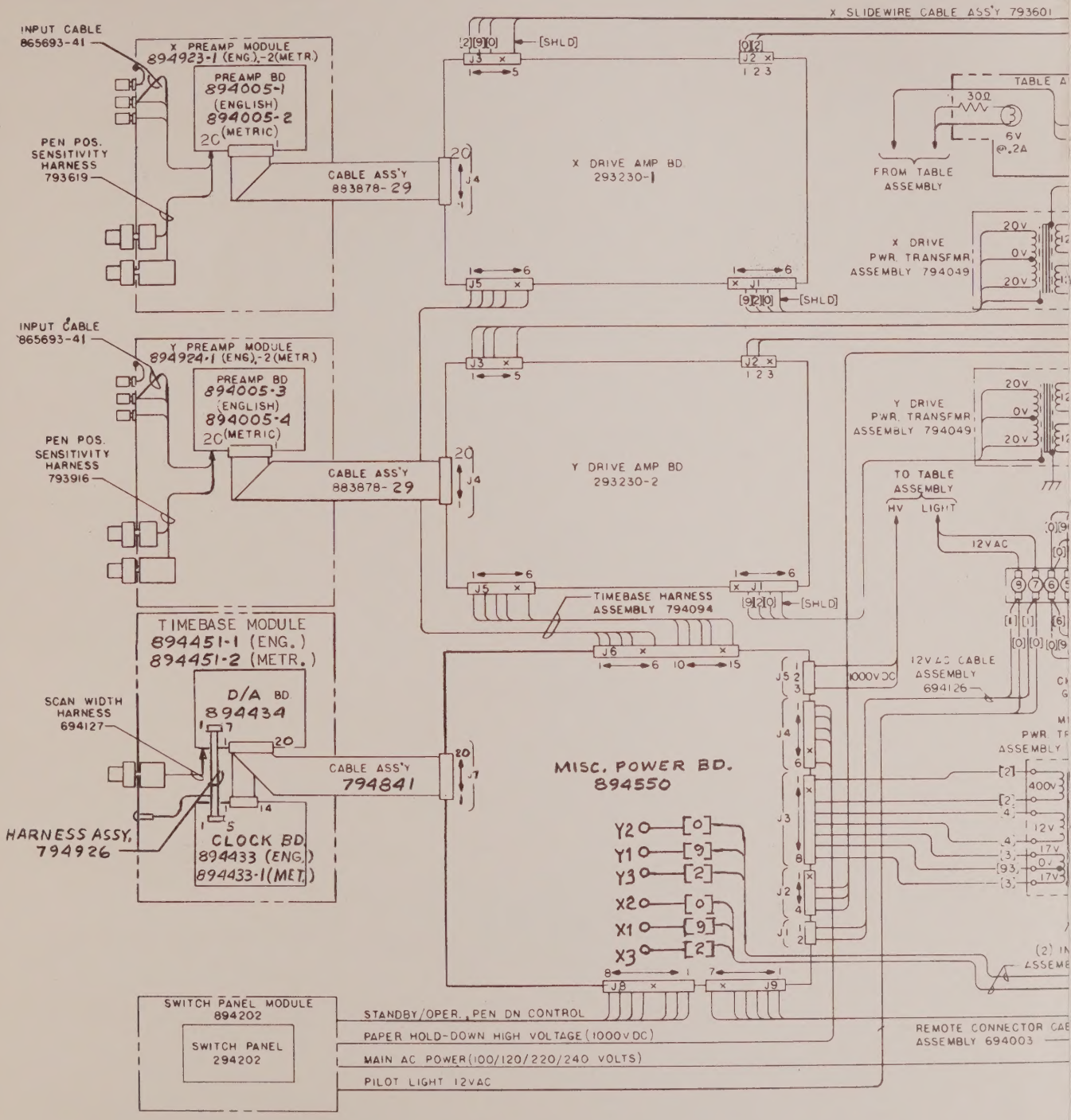
BY	DATE
DR COMELLA	4 22 80
CH. Francis	2/81
APP. Krogget	3/81

NAME: SYSTEM SCHEMATIC 3056

CODE IDENT. 96795 ISSUE CODE G

Gould Inc. Instruments Division Cleveland, Ohio 44114 U.S.A.

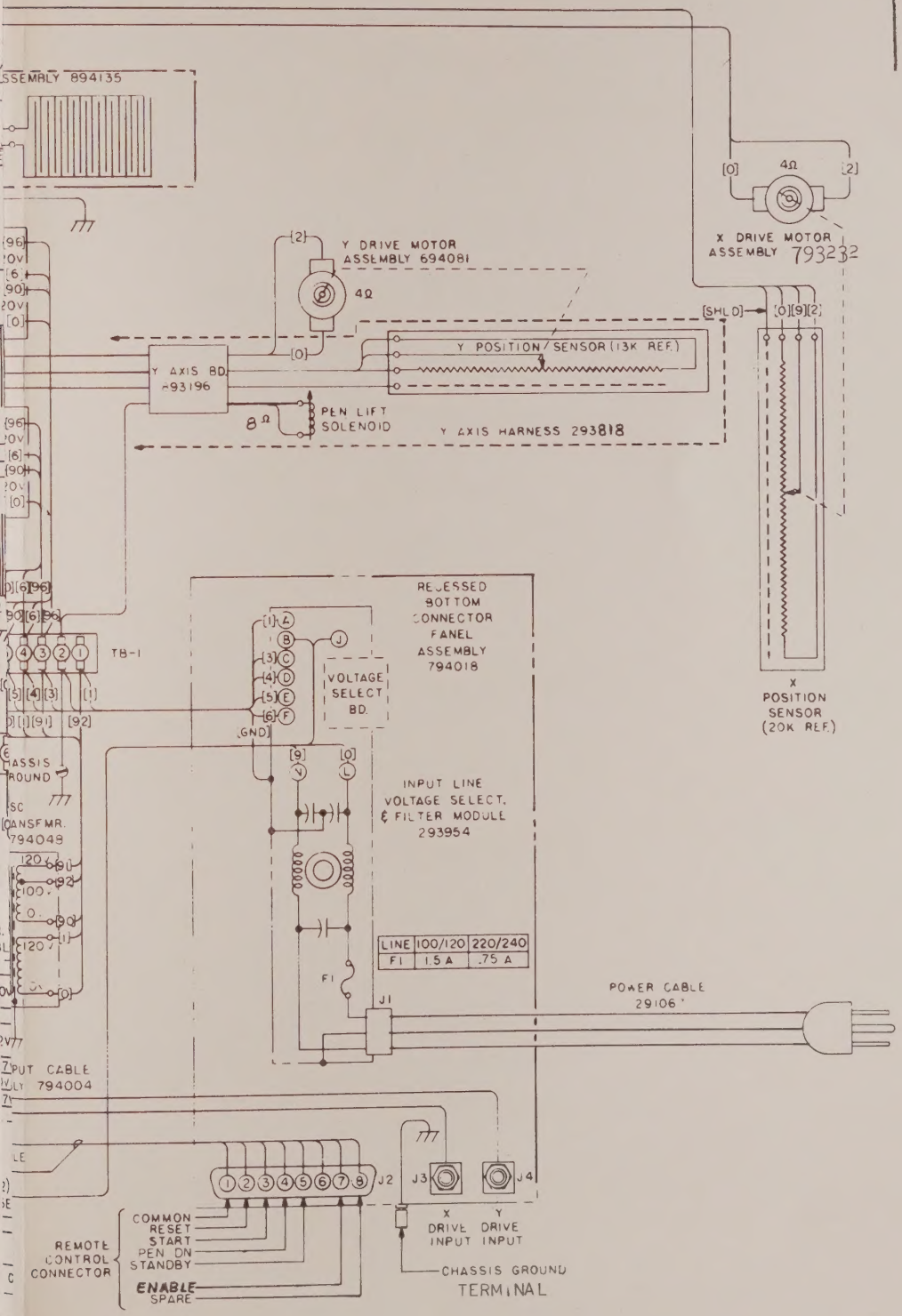
DWG. NO. 294803



6. REMOTE INPUT "COMVON" IS FLOATING (± 100V DC) WITH RESPECT TO CHASSIS OR SIGNAL INPUTS.
5. HEAT SINKS ON DRIVE AMPLIFIERS ARE AT CHASSIS GROUND (ISOLATED FROM CIRCUIT GROUND).
4. NUMBERS BEGINNING WITH 6, 7, OR 8, ARE ASSEMBLY DRAWINGS.
3. NUMBERS GIVEN AS 2XXXXX ARE SCHEMATIC DIAGRAM DRAWINGS.
2. X = POLARIZING KEY
1. [ ] = E.I.A. COLOR CODE

NOTES;

REP. 294224 REVISIONS		
SYM.	DESCRIPTION	DATE
A-1	REVISED PER DCN 27673 J.COMELLA	2-6-81



15-3307-02,08,12,18 3052 X-Y RECORDERS

BY	DATE	NAME	Gould Inc. Instruments Division Cleveland, Ohio 44114 U.S.A.
DR COMELLA	10/31/80	SCHEMATIC	
CH Lenarcic	12/2/80		
Bubbe	12/3/80		
		CODE IDENT. 96795	ISSUE CODE G
			DWG NO. 294818

www.manualsplus.com
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Gould Inc., Instruments Division
3631 Perkins Avenue, Cleveland, Ohio 44114
Telephone (216) 361-3315

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Electronics & Electrical Products